Conference Program

“Game Theory and Society”

Models of Social Interaction in Sociological Research

ETH Zürich
July 27-30 2011
www.socio.ethz.ch/workshop2011

Organizers:
Andreas Diekmann, Dirk Helbing, Ryan O. Murphy
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1 Introduction

Social interaction is a key concept in sociological thinking. If ego’s payoffs depend on alters’ choices, interactions are strategic. Game theory provides a precise, formal language to model situations of strategic interactions. While standard game theory builds on the concept of strictly rational actors, behavioral game theory modifies the restrictive assumptions by incorporating more realistic psychological motives in models of game theory. New developments, such as models of incomplete and asymmetric information, signaling models, the theory of repeated games, and evolutionary game theory enrich the applicability of game theory to sociological problems. For example, game theory led to new insights on the problems of social order and cooperation, contribution to collective goods, the emergence and stability of social norms, the problem of trust and commitment in social and economic transactions, to mention a few. Although game theory came into sporadic use in sociology since the 1960’s, it has yet not become mainstream, not even in rational choice sociology. This situation is in stark contrast to the obvious potential of game theory and recent developments of modern game theory, behavioral game theory and experimental work for sociological research.

The aim of the conference is to explore the potential of game theory for sociological theory and its application to sociological research broadly considered. For this purpose the conference brings together scholars with different disciplinary backgrounds to focus on topics of game theory relevant to sociology and society at large.

The “Game Theory and Society” conference is supported by ETH Zurich, the “Models and Simulation” Section of the German Sociological Association (DGS), and the Future and Emerging Technologies Programme FP7-COSI-ICT of the European Commission through the project QLectives (Grant No. 231200).

Andreas Diekmann, Dirk Helbing, Ryan O. Murphy

(From the Call-For-Papers)

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<td>Dirk Helbing: Cooperation, Norms, and Conflict: Towards Simulating the Foundations of Society</td>
<td>Rainer Hegselmann: From small groups to large groups. Modeling Hume’s moral and political theory</td>
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<td>17:15-18:00</td>
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<td>Chris Snijders: Schelling’s Segregation Model. An Overview of 40 Years of Follow up Studies</td>
<td>Karl Sigmund: A Theoretical Approach to Institutionalized Incentives of Public Good Games: When Leviathan meets the Social Contract</td>
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Rooms

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<td><strong>Devesh Rustagi:</strong> Leader Social Preferences and Group Performance: Experimental Evidence From Ethiopia</td>
<td><strong>Ruben Requejo:</strong> The Joker Effect: Cooperation driven by Destructive Agents</td>
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<tr>
<td>9:30-10:00</td>
<td><strong>Heiko Rauhut:</strong> Lifting the Veil of Ignorance: An Experiment on Normative Compliance</td>
<td><strong>Christoph Graf:</strong> Parameters of Social Preference Functions: Measurement and External Validity</td>
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<td><strong>Güther Kainz:</strong> Do self-reported Strategies Match Actual Behavior in Social Preference Experiments?</td>
<td><strong>Floria, Mario:</strong> Selective Advantage of Tolerant Cultural Traits in the Axelrod-Schelling Model</td>
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<td>10:30-10:45</td>
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<td>10:45-11:15</td>
<td><strong>Axel Franzen:</strong> Testing the External Validity of Giving in the Dictator Game</td>
<td><strong>Andreas Tülic:</strong> A Theory of Status-Mediated Inequality Aversion</td>
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**Session Chair:** Stefan Pickl, Wojtek Przepiorka, Stefan Wehrli  
**Room:** CAB G 11, CAB G 61, CAB G 59

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<tr>
<td>9:00-9:30</td>
<td><strong>Martin Abraham:</strong> The Emergence of Reputation in Economic Transactions</td>
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<td>10:00-10:30</td>
<td><strong>Wojtek Przepiorka:</strong> Is Charitable Giving a Costly Signal of Cooperative Intent? Decomposing the Benefits of Altruistic Acts</td>
<td><strong>Fabio Tufano:</strong> Does Oneness Explain Coordination? An Experimental Study on the Importance of Relationship Closeness for Coordination Success</td>
<td><strong>Stephan Schlosser:</strong> The Public Loss Game - An Experimental Study of Public Bads</td>
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<td>10:30-10:45</td>
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<td><strong>Amrish Patel:</strong> Does Category Reporting Increase Donations to Charity? A Signaling Game Approach</td>
<td><strong>Vincenz Frey:</strong> Embedding Trust in Information-exchange Relations: A Game-theoretic Model for Investments in and Returns on Social Capital</td>
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<td><strong>Károly Takács:</strong> The Viability of Fake Signaling and Cooperation in Structured Populations</td>
<td><strong>Jelena Grusic:</strong> Prisoner’s Dilemma on a Sizeable Network: Experiment and Theory</td>
<td><strong>Flaminio Squazzoni:</strong> Does Incentive Provision Increase the Quality of Peer Review? A Game-Theory Experimental Study</td>
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<td>11:45-12:15</td>
<td><strong>Thomas Gautschi:</strong> A Nash Bargaining Model for Exchange Networks</td>
<td><strong>Dirk Semmann:</strong> Interacting with Several Social Partners Decreases Cooperation</td>
<td><strong>Hendrik Vollmer:</strong> What kind of game is everyday interaction?</td>
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**Session Chair:** Heiko Rauhut, Thomas Grund, Kurt Ackermann  
**Room:** CAB G 11, CAB G 61, CAB G 59
3 Abstracts

3.1 Plenary Sessions

The Emergence of Social Norms Among Heterogeneous Actors

Andreas Diekmann & Wojtek Przepiorka (ETH Zurich)

Most studies of social norms in experimental game theory focus on how to sustain social norms and cooperation. In this study the primary goal is to explore how social norms evolve in a social dilemma. Also, we consider interactions with players who vary in "strength", i.e. have smaller or larger resources to contribute to a collective good. The study of norm emergence is based on the volunteer’s dilemma. In this game there is both a coordination problem and a conflict of interest.

Volunteer’s dilemma is a N-person game where one actor’s cooperation is sufficient to produce the collective good. The volunteer’s dilemma has many applications in the behavioral sciences as well as in the area of animal behavior. Also, the well-known social-psychological principle of "diffusion of responsibility" follows from the mixed Nash equilibrium strategy of this game. An important extension of the dilemma allows for inequality of actor’s payoffs. In the asymmetric dilemma strong players have either lower cost to produce the collective good or higher utilities from attaining the public good than weak players have.

We want to know if subjects learn to solve the conflict between the narrow self interest and the common good by establishing certain types of social norms. There are two types of equilibria in the asymmetric dilemma. The mixed strategy equilibrium implies the paradoxical characteristic that the weakest player has the highest likelihood to produce the collective good. On the other hand, there are equilibria in pure strategies. We predict that the strongest actor will cooperate while all other players defect resulting in a Pareto optimal equilibrium. We expect that a social norm of cooperation will evolve such that strong players will decide for cooperation more frequently than weak players. Moreover, we hypothesize that - compared to symmetric interaction structures - heterogeneity will increase the likelihood of efficient cooperation.

Most studies of norm compliance assume social norms as given. Here we explore the emergence of different types of social norms under various structural conditions. Particularly, we compare norm emergence in a homogeneous versus a heterogeneous setting. We test our hypotheses in three experiments.
with sequences of repeated dilemma games.

Our experimental findings clearly indicate (1) that different types of social norms evolve in the symmetric and the asymmetric structure (2) whereby learning is important. (3) Heterogeneity promotes cooperation and the efficient solution of the dilemma. (4) In one-shot interactions with strangers the "qualitative difference" between the symmetric and the asymmetric game matters but the quantitative degree of strength does not. (5) The increase in cooperation is at the expense of the strong player. In the asymmetric game the strong actor has to pay and is exploited by free riding co-players.

In a fourth experiment the game is applied to a sanctioning dilemma. In contrast to public good games with punishment a single actor is sufficient to sanction a violation of a norm. Here too, in the asymmetric situation strong actors exert costly punishment more often than weak actors. In both the symmetric and the asymmetric situation sanction opportunities increase the level of cooperation.

**Human Nature and Social Interaction – Behavioral & Analytical Foundations of Sociology**

_Ernst Fehr (University of Zurich)_

Since Durkheim, sociological explanations of social cooperation have emphasized the internalization of values that induce norm compliance. Since Adam Smith, economic explanations of social cooperation have emphasized incentives that induce selfish individuals to cooperate. Here, we develop a general approach – the Beliefs, Preferences, and Constraints approach – showing that each of the above models is a special case. Our approach is based on evidence indicating that pure Homo Sociologicus and pure Homo Economicus views are wrong. We show that self-regarding and norm-regarding actors coexist and that the available action opportunities determine which of these actor types dominates the aggregate level of social cooperation. Our approach contributes to the solution of long-standing problems, including the problems of social order and collective action, the determinants and consequences of social exchanges, the microfoundations of emergent aggregate patterns of social interactions, and the measurement of the impact of cultural and economic practices on individuals’ social goals.

**Humans prefer establishing pool punishment to maintain the commons**

_Manfred Milinski, Torsten Roehl & Arne Traulsen (Max-Planck-Institute for Evolutionary Biology, Germany)_

Punishment can stabilize costly cooperation and ensure the success of a common project. Punishment mechanisms can be classified into pool-punishment, where the punishment act is performed by a third party, a "police institution", and the more common idea of individual peer-punishment, where individuals ensure the good conduct of others. When both punishment options are simultaneously available, which one will be preferred? In a behavioral experiment, we show that pool-punishment prevails over peer punishment when those who cooperate, but do not punish are also subject to punishment. Pool punishers are trapped as such, and the police system is thus stable. However, "efficiency is traded for stability", stable cooperation comes at a price since taxes for the pool punishment system have to be paid even in the absence of defectors. Our experimental results support predictions of a recent mathematical model and suggest how organized punishment could have displaced individual punishment in modern human societies.
Evolutionary dynamics of Climate Change under the Collective Risk Dilemma

Jorge Pacheco & Francisco C. Santos (University of Minho)

When deciding to take measures to avoid global warming, individuals often face a social dilemma in which, besides securing future benefits, it is also necessary to reduce the chances of future losses. This turns the "risk of failure" into a central issue in individual decision. We model this social dilemma in terms of a public goods game of cooperation in which benefits do not increase proportional to the investments made, and in which the perception of risk biases individual decision to cooperate or not in the game. I show how the outcome of cooperation is strongly dependent on the ratio between the amount invested by each individual and her perception of risk regarding the future. Increasing the perception of risk in a collective dilemma where defection dominates, leads to the emergence of a rich dynamics with scenarios of both coordination and co-existence, from which cooperation emerges. I will describe the evolutionary dynamics of cooperation in the presence of risk. The results suggest that global coordination for a common good should be attempted by segmenting tasks in many small to medium sized groups in which perception of risk is high and achievement of goals involves stringent requirements. Finally, I show how networking groups along the links of a scale free network further enhances the chances of coordinating to tame the planet’s climate.

The Kula-Ring of Bronislaw Malinowski - Co-Evolution of an Economic and Ceremonial Exchange System

Rolf Ziegler (LMU Munich)

The Kula ring described by Bronislaw Malinowski in 1922 is a system of the ceremonial exchange of gifts, which links numerous partners directly and indirectly in a ring-like structure, and where two ceremonial gifts (vaygu’a) continually circulate in opposite directions. The theoretical interpretations of the Kula so far presented have mainly concentrated on the functions of this institution but have neglected the question of a starting mechanism that could account for the spontaneous emergence of peaceful exchange which builds only upon the strategic situation of dyadically interacting potential partners having an incentive to trade but being uncertain about the intentions of potentially hostile foreigners and (at least in the beginning) not being bound by a universally accepted "norm of reciprocity" which does not only apply to clan members but to strangers too. Our basic aim is twofold: (1) to theoretically derive the behavioral assumptions of a starting mechanism for the emergence and co-evolution of a peaceful system of economic and ceremonial exchange from game-theoretic reasoning and (2) to use simulation as a methodological device in order to demonstrate the macro-social consequences of a multi-level, multi-agent, dynamic system and compare them with the observed structure.

Analytical Foundations of Sociological Game Theory

Herbert Gintis (Santa Fee Institute)

Several key analytical facets of classical game theory prevent its full integration into sociological theory and prevent game theory from adequately modeling such phenomena as social norms, morality, justice, and the dynamics of belief formation and change. In each case, I will suggest analytical alternatives that may ease the transition to a satisfactory sociological game theory.
Naturalizing the Social Contract

Brian Skyrms (ETH Zurich)

I give an introduction to the use of evolutionary game theory as a tool for naturalizing the social contract, with special emphasis on dynamics and on correlation.

The 1/d Law of Giving

Jacob Goeree (University of Zurich)

We combine data collected on friendship networks and individual characteristics with experimental observations from a sequence of dictator games run at an all-girls school in Pasadena, California. Our analysis provides two sets of insights. First, we find that dictator giving is primarily explained by social distance, defined as the length of the shortest path connecting a dictator and recipient in their (elicited) network of friends. In fact, dictator offers follow a simple inverse distance law. Second, while student demographics play a minor role relative to network effects in explaining offer amounts, individual heterogeneity is important for the network formation process. In particular, we detect significant homophilous behavior – students tend to connect to others similar to them. In addition, the network data reveal a strong preference for cliques – students tend to connect to those that are already close. The study serves as one of the first to identify network architecture with individual behavior and outcomes in a strategic context.

Cooperation, Norms, and Conflict: Towards Simulating the Foundations of Society

Dirk Helbing (ETH Zurich)

In order to understand social systems, it is essential to identify the circumstances under which individuals spontaneously start cooperating or developing shared behaviors, norms, and culture. In this connection, it is important to study the role of social mechanisms such as repeated interactions, group selection, network formation, costly punishment and group pressure, and how they allow to transform social dilemmas into interactive situations that promote the social system. Furthermore, it is interesting to study the role that social inequality, the protection of private property, or the on-going globalization play for the resulting “character” of a social system (cooperative or not). It is well-known that social cooperation can suddenly break down, giving rise to poverty or conflict. The decline of high cultures and the outbreak of civil wars or revolutions are well-known examples. The more surprising is it that one can develop an integrated game-theoretical description of phenomena as different as the outbreak and breakdown of cooperation, the formation of norms or subcultures, and the occurrence of conflicts.

Schelling’s segregation model. An overview of 40 years of follow up studies

Chris Snijders (TU Eindhoven)

Schelling’s segregation model has been cited often. However, what have social (and other) scientists learned about this seminal paper? Which kind of follow studies have been tried? Has it affected research on urban segregation and how? Has the game-theoretical aspect of the paper found its way into contemporary research? The presentation will show an overview of four streams of follow-up research on the segregation model, and will emphasize which kinds of research have typically stayed underdeveloped.
Trust and social Embeddedness

W. Raub (Utrecht University)

Applications of game theory in sociology often focus on effects of social embeddedness on trust and cooperation in social and economic exchange and in social dilemmas. "Social embeddedness" refers to repeated interactions and to networks of relations. We sketch empirical findings on embeddedness effects from studies using complementary research designs: surveys, vignette studies, and experiments. Using such complementary designs for repeated tests of the same hypotheses is advocated as a strategy for establishing the robustness of empirical findings.

Leadership and Credibility in Games

Roberto Weber (University of Zurich)

Laboratory experiments using games, and coordination games in particular, represent a valuable tool for understanding the factors that underlie effective leadership. In such contexts, effective leadership involves not only influencing individual’s beliefs, but also their beliefs about others’ beliefs. Therefore, maintaining credibility and legitimacy can be difficult and may be highly influenced by the context and personal characteristics of the leader. In this presentation, I briefly review my research exploring the conditions under which leadership is effective in such simple laboratory environments, and what we can learn about leadership more broadly from the findings.

The Model of Frame-Selection: Towards a General Theory of Action

Hartmut Esser (University of Mannheim)

The contribution offers a (short) overview over the central elements of the Model of Frame-Selection and connects its assumptions and implications to some other (old and new) attempts to overcome the shortcomings of (traditional) rational-choice-theory as well as of various other approaches for an adequate micro-foundation of social sciences (by preserving the central advantage of rational-choice-theory: its precision and logical content). Similarities and differences to other (recent) approaches will be discussed, for instance to extensions of rational choice theory to “wider” versions of motives and restrictions, to theoretical reconstructions of results of experimental game theory or to the concept of “goal framing”. Additionally, some empirical results will presented, which show (at least), that the model is not simply a special (and complicated) case of (wide version of) rational-choice-theory, but a concept that integrates the different concepts in a comprehensive framework by explicating the conditional validity of the one or the other approach and, thus, as special cases of the Model of Frame-Selection.

From small groups to large groups. Modelling Hume's moral and political theory

Rainer Hegselmann (University of Bayreuth)

Hume’s moral and political theory is about the problems, helpful inventions, and driving mechanisms of the evolution of societal forms from small to large groups. Hume’s theory is rich and informal and although over 250 years old, it is still a modern theory. HUME 1.0 is a computer model that reconstructs this theory and that gives detail and precision to the complex and dynamic interplay of trust and trustworthiness, the division of labour, and material wealth. The chapter describes the components of HUME 1.0, solutions of design problems, some initial results, and further research perspectives.
A theoretical approach to institutionalized incentives of Public Good games: when Leviathan meets the Social Contract

Karl Sigmund (University of Vienna)

This lecture deals with the evolutionary dynamics of incentives (punishment and reward). It shows that the effect of voluntary participation is much larger for negative than for positive incentives.

The weak side of informal social control

Andreas Flache (University of Groningen)

Informal social sanctions can be a powerful solution to the free rider problem that groups face when collective goods are to be produced. Common wisdom in sociology has it that cohesive social networks in particular facilitate informal control and thus sustain successful collective action. In this contribution the possible weak side of informal control in cohesive networks is analyzed. Social control is modeled based on a repeated exchange game that involves both contributions to the collective good as well as bilateral exchanges of social rewards. It is shown that under certain conditions - notably uncertainty about others’ contributions and relatively high contribution costs - rational behavior may entail a "weakness of strong ties". Actors build cohesive social networks based on mutual social reward but fail to produce the collective good. Results from empirical tests of the argument are presented. Finally, extensions towards the analysis of effects of network structure on cooperation will be discussed.

Simple heuristics in a social world

Ralph Hertwig (University of Basel)

Recent research has proposed a variety of simple heuristics for making adaptive inferences and decisions. These heuristics can solve real-world adaptive problems quickly and effectively. Some have argued that heuristics work well in the nonsocial world but are doomed to fail in social environments, which are said to be more intellectually demanding. In this talk, I will engage this criticism and propose that human social intelligence is not qualitatively different from nonsocial intelligence and that important aspects of both kinds of intelligence can be understood in terms of heuristics and other simple mental tools.

Lies in disguise – on honesty and deception

Urs Fischbacher (University of Konstanz)

Honesty is considered a virtue but lies are abundant. In the talk, an experiment will be presented that allows assessing the honesty of a population with revealing whether an individual deceives. We find that about one third of the subjects are honest, and interestingly many subjects do cheat but seem to try to hide their lie. We discuss what kind of models can account for this behavior and present an experiment that allows testing the credibility of the hidden lies.
Self-favoring and Other-Favoring In Repeated Two-Person Interactions

Ramzi Suleiman (University of Haifa)

I propose a novel two-person repeated game, discuss its properties and utilize it to systematically investigate individualistic, cooperative, and altruistic behaviors in a class of dyadic interactions. The results of the reported experiments are used to draw some conclusions about the prospects of cooperation and of costless and costly altruism, when betrayal by one partner is possible or impossible.

Measuring other regarding preferences

Ryan O. Murphy (ETH Zurich)

Narrow self interest is often used as a simplifying assumption when studying people making decisions in social contexts. Nonetheless, people exhibit a wide range of different motivations when choosing among interdependent outcomes. Measuring the magnitude of the concern that decision makers have for others has been the focus of many social scientists for decades and several different measurement methods have been developed thus far. We discuss here a new measure of other regarding preferences that has several advantages over existent methods. A detailed description of the new measure is provided, along with norming data that provides evidence of its solid psychometric properties.

3.2 Session “Social Norms”

The emergence of norms from conflicts over just distributions

Luis Miller, Heiko Rauhut & Fabian Winter (Max-Planck-Institute of Economics, Jena)

Why is it that well-intentioned actions can create persistent conflicts? While norms are widely regarded as a source for cooperation, this article proposes a novel theory in which the emergence of norms can be understood as a bargaining process in which normative conflicts explain the finally emerging norm. The theory is tested with a dynamical experiment on conflicts over the consideration of equality, effort or efficiency for the distribution of joint earnings. Normative conflict is measured by the number of rejected offers in a recursive bargaining game. The emerging normative system is analyzed by feed-back cycles between micro- and macro-level. It is demonstrated that more normative cues cause more normative conflict. Further, under the structural conditions of either simple or complex situations, the convergence towards a simple and widely shared norm is likely. In contrast, in moderately complex situations, convergence is unlikely and several equally reasonable norms co-exist. The findings are discussed with respect to the integration of sociological conflict theory with the bargaining concept in economic theory.

Lifting the veil of ignorance: An experiment on normative compliance

Andreas Diekmann, Wojtek Przepiorka & Heiko Rauhut (ETH Zurich)

The classical sociologist Popitz (1968) suggested the hypothesis about the so-called “preventive effect of ignorance”. This hypothesis states that ignorance of norm violations promotes norm compliance. Thus, if the actual extent of norm violations was known, the normative system would deteriorate. We tested this theory by implementing a simple laboratory experiment (n = 466), in which subjects could commit a violation of the honesty norm. Subjects threw a die and were paid according to their reported number. Our design guaranteed complete anonymity by ruling out the possibility of personal identification so
that subjects could lie about their thrown number to yield higher earnings. The aggregate distribution of reported payoffs allowed determining the extent of liars in the population. In the first experimental condition, we lifted the veil of ignorance by providing information about the distribution of reported payoffs of a large group of other participants. In the second condition, we showed the distribution of the own group. A second throw after information feedback revealed that knowledge about lying triggered subsequently more lying compared to the control condition without information feedback. While earlier studies could not distinguish between effects of punishment and conditional norm compliance, our design eliminated any punishment threat. Thus, our results are novel in demonstrating the spread of norm violations by the exclusive mechanism that individuals condition their compliance on information about norm violations of others.

Social Norms, Costly Punishment and the Evolution of Cooperation

Tongkui Yu, Shu-heng Chen & Honggang Li (Beijing Normal University)

Within a co-evolution framework of reputations, strategies and social norms, we study the role of punishment in the promotion of cooperation. Norms differ in whether they allow or do not allow the punishment action to be a part of the strategies, and, in the case of the former, they further differ in terms of whether they encourage or do not encourage the punishment action. In such a framework, depending on the applied social norm, players are first given different reputations based on their employed strategies. Players then update their strategies accordingly after they observe the payoff differences among different strategies. Finally, over a longer horizon, the evolution of the social norms may be driven by the average payoffs of all members of the society. The strategy dynamics are articulated under different social norms. It is found that costly punishment does contribute to the evolution toward cooperation. Not only does the attraction basin of the cooperative evolutionary stable state (CESS) become larger, but the speed of convergence to the CESS also becomes faster. These two properties are further enhanced if the punishment action is encouraged by the social norm.

Testing the External Validity of Giving in the Dictator Game

Axel Franzen & Sonja Pointner (University of Bern)

Studies investigating the external validity of experimental behavior are challenging and rare. However, such studies are important since experiments leave the question unanswered of how the participants behave outside the laboratory. Observing subjects in the real world has to meet two conditions: the observation must be concealed from subjects and the decision situation in the field must be comparable to the one studied in the lab. We use the misdirected letter technique (MDL), trying to accomplish this. First, our subjects participated in standard dictator games conducted in a lab. Some of our subjects left their addresses to be contacted again for further laboratory studies, 27 of them lived in a single household, which is important for conducting the MDL. A couple of months later, we dropped prepared letters into their mailboxes. The envelope and the content of the letter were designed in such a way that subjects should get the impression that the letter was misdirected by the mail delivery service. The letter contained 10 Euro (same amount as in the lab) that were included as a gift by a relative of the intended receiver for good school grades. We observe whether and how the misdirected letters were returned and how that behavior relates to the one observed in the lab.
Groupthink: Theory and Evidence

Gerald Schneider, Christopher Baker & Hanja Blendin (University of Konstanz)

One of the most influential concepts in the social sciences is the notion of "groupthink" that Irving Janis introduced in the early 1970s. His approach suggests that committee decision making in situations of stress and with high levels of group cohesion leads to deficient outcomes. The empirical support that these interrelated hypotheses received so far is, however, limited. Also, the theoretical foundations of the groupthink model have not been brought in line with advances in the formal theory of group decision making. To overcome these limitations, we introduce in this article a new theoretical framework as well as a modern experimental design. Based on recent game-theoretic versions of the Condorcet Jury Theorem, we first develop a rational choice model for individual behavior in a group context to explain why evidently competent committee members may make inappropriate decisions despite advice to the contrary. The model suggests that limited confidence in one’s own ability to make a correct choice is key to poor decision making quality. We test in a computer experiment how group cohesion and stress in the form of time pressure influences decision making quality. The experiments with more than 100 subjects show a) that time pressure directly lowers decision making quality and b) that increased group cohesion has an indirect detrimental effect through a lowered self-confidence of the subject. We discuss the implications of this model for deterrence theory and contrast the model and the experimental findings with some alternative possibilities to develop modern theories of groupthink.

Predicting contribution levels in anonymous one-shot Public Goods game

Kurt Ackermann & Ryan Murphy (ETH Zurich)

There is a large body of evidence showing that a substantial proportion of people contribute positive amounts in Public Goods games, even if the situation is one-shot and completely anonymous. Clearly, this is in conflict with the prediction standard economic theory makes. One of the most promising explanations why people deviate from normative behavior in this context refers to an interaction between peoples’ social preferences or social value orientation (SVO) and their beliefs about the behavior of others. We follow this line of thinking and extend it by suggesting that the inclusion of a third variable may further explain contribution levels in an anonymous one-shot Public Goods game, namely people’s beliefs about other people’s SVOs. We find that these three variables (SVO, beliefs about other people’s contributions in the Public Goods game, and beliefs about other people’s SVOs) together account for almost 50% of the variance in contribution levels. Moreover, we find a significant three-way interaction between these variables. When incorporating the interaction terms in the model, the explained variance in peoples’ Public Goods contributions nears 52%.

3.3 Session “Social Preferences”

Leader Social Preferences and Group Performance: Experimental Evidence From Ethiopia

M. Kosfeld & D. Rustagi (ETH Zurich)

We use a third party punishment game to investigate if actual leaders vary in their social preferences to enforce cooperation norms and if this variation is associated with success in forest commons management. We find that leaders vary in their social preferences: most did not punish; others punish deviation from the equality norm, deviations from equality and efficiency norms, and irrespective of deviation from any norm (anti-social). Ratings in a household survey support our characterization and
show that anti-social leaders are more likely to be rated bad. Group performance is positively associated with equality and efficiency driven leaders, but negatively with anti-social leaders. We also find that in groups with anti-social leaders, conditional cooperators not only contribute less but also expect higher punishment if they belong to a different clan than the leader. These findings have implications for the design of organizational and development policies and provide external validity to laboratory experiments.

Parameters of social preference functions: Measurement and external validity

Christoph Graf, Rudolf Vetschera & Yingchao Zhang (University of Vienna)

Most of the existing literature on social preferences either tests whether certain characteristics of the social context (like intentions of others) influence individual decisions at all, or tries to estimate parameters of social preference functions describing such behavior at the level of the entire population. In the present paper, we are concerned with measuring parameters of social preference functions at the individual level. We draw upon concepts developed for eliciting other types of utility functions, in particular the literature on decision making under incomplete information. Our method derives parameters of social preference functions from indifference statements about the distribution of payoffs in a group. We apply our method in a controlled social preference experiment to establish the external validity of estimated parameters. Our results show the expected relationships to some external factors (like educational background of subjects), and also a strong correspondence between parameter estimates and factors that according to the subjects’ own descriptions influenced their behavior. We also find that some concepts discussed in the literature on social preferences, in particular envy towards players receiving a larger payoff, have very diverse and complex effects at the individual level.

Do self-reported strategies match actual behavior in social preference experiments?

Rudolf Vetschera, Katrin Nimczick & Guenther Kainz (University of Vienna)

According to many models, social preferences are influenced by features of payoff distributions like the payoff to the group member who is worst off, or higher payoffs to other members possibly causing envy. In this paper, we explore if subjects in social preference experiments consciously take these elements into account. To study this question, we performed an experiment in which subjects stated indifference values of unequal payoff distributions, and explicitly reported on the strategies they used in stating these values. This approach allows us to obtain a cardinal measure of their social preferences, and to study the impact both of user characteristics and stated strategies on these values. Our results indicate that although experimental factors, like group composition or field of study of subjects, are significantly related to self-reported strategies, they do not have a statistically significant impact on the indifference values given. On the other hand, there is a significant relationship between self-reported strategies and actual behavior. Furthermore, our results indicate that the salience of different payoff distribution characteristics, and the impact of different motives on actual decisions, is context dependent.

A Theory of Status-Mediated Inequity Aversion

Andreas Tutic & Ulf Liebe (University of Leipzig)

We introduce a new social utility function which relates inequity aversion to social status, effort, and ability. The basic idea is as follows: Actors do not suffer from inequality but from inequity relative to a fair share that reflects some normative orientation the actors have internalized. In this regard we advocate the rule of proportionality which states that rewards should be proportional to some standard
of comparison. We apply this social utility function to various games from non-cooperative and cooperative game theory and interpret the results with respect to the effects of social status on behavioral outcomes.

**Negative social preferences in intergroup settings**

*Michael Maes, Jacob Dijkstra & Johannes Ackva (Utrecht University)*

Identifying conditions under which individuals contribute to collective goods of their groups and thereby increase group welfare is one of the core efforts of the social sciences. However, in intergroup settings, contributions to collective goods of one’s group might decrease welfare of outgroup members and the population as a whole. Moreover, prominent social psychological theories hold that individuals seek to increase payoff differences between groups and, thus, contribute more to collective goods of their own groups, suggesting that populations might end up in highly inefficient situations.

The aim of this study is to test whether intergroup settings entail such negative social preferences, a proposition that highly debated in the literature on intergroup relations. On the one hand, a key assumption of social identity theory presumes that individuals seek to maximize status differences between salient in and outgroups. Supporting this notion, experimental research along the minimal group paradigm found that subjects prefer money allocations which maximize payoff differences between groups even if this decreases their individual payoff. On the other hand, classical theories of intergroup prejudice and recent theories on intergroup categorization hold that group membership implies negative feelings towards a salient outgroup only under very limited conditions. In line with this claim, recent experimental research on intergroup conflict games found that subjects prefer to contribute to a collective good of their groups in a way that does not affect a given outgroup, suggesting that it is not "outgroup hate" but in "ingroup love" that motivates contributions.

Based on a formal model of intra and intergroup social-preferences, we developed an experimental design which allows drawing conclusions about the nature of social preferences towards outgroups. In this experiment (N=150), two groups of three subjects faced a collective good problem. Using a between and within subjects design, we manipulated whether contributions to the collective good of one’s group increased (harmony-condition), decreased (conflict-condition) or did not affect (baseline-condition) the collective good of the other group. Furthermore, subjects indicated their expectations concerning average contributions of their in and outgroup and received additional compensation for good guesses. This information was used to assess subjects’ expectations about group contributions.

Results show that contributions in the harmony treatment hardly differed from the baseline condition. In the conflict treatment, however, subjects contributed significantly less. This indicates that subjects had no negative social preferences towards the outgroup. Furthermore, contributions were related to expected contributions of ingroup members, indicating positive social preferences with regard to the ingroup. With regard to the outgroup, however, we found only in the harmony treatment a positive effect, suggesting that in conflict treatment subjects did not consider outgroup members’ decisions.

These results do not support that perceiving distinct groups entails negative social preferences. Strikingly, this suggests that group conflicts may not be caused by negative feelings towards outgroups but by the motivation to increase payoffs of ingroup members.

Note to the organizers: Please note that we are currently conducting further experiments which we will also include in the presentation. In the new experiments, subjects have the opportunity to communicate with their ingroup members before they contribute to the collective good, a method which is known to promote the production of collective goods. Preliminary results show very high contributions in the harmony condition and lower contributions in conflict. This shows that lower contributions in the conflict treatment are not caused by the fact that groups fail to produce the collective good of hurting the other group. Instead, this supports that subjects do not seek to decrease payoffs of outgroup members.
This provides further support for the notion that group conflicts may not be the result of outgroup hate but mainly emerge from ingroup love.

**Thin Slices of Preferences: Predicting Strategic Behavior Given Limited Information**

*Sonja Vogt & Charles Efferson (University of Zurich)*

Green beards are a metaphor for any conspicuous trait that is strongly associated with an unobservable preference to behave prosocially. If such a trait exists, individuals bearing the trait will behave prosocially. If they also interact with others having the same trait, they can exclude less prosocial individuals from their social interactions. This will allow them to enjoy the benefits of mutually prosocial behavior without the costs of being exploited by defectors. The problem, however, is that known evolutionary mechanisms cannot plausibly produce and maintain the required association between the observable trait and the unobservable preference for prosocial behavior in social dilemmas. Nevertheless, recent studies have suggested that green beards might actually exist in humans. Importantly, however, the more general task is to find how much information someone needs about another person, in different strategic situations, to cross the threshold between random guesses about that person’s behavior and accurate predictions. To answer this question, we conducted three studies in which we varied the amount of information available about a subject who had played one of three games: a trust game, a stag hunt game, or a prisoner’s dilemma. Specifically, independent raters saw either still photographs or silent videos of subjects who had played one of the three games, and then the raters had to predict subject behavior. According to evolutionary theory, raters should be able to predict accurately in coordination games like stag hunt, but not in social dilemmas like the trust game and prisoner’s dilemma. Our results show that, although raters paid attention to the attractiveness and the sex of subjects, in all three settings this led to little or no gain in the ability of raters to predict behavior accurately.

### 3.4 Session “Evolutionary Game Theory”

**The joker effect: Cooperation driven by destructive agents**

*Ruben J. Requejo, Alex Arenas, Juan Camacho & Jose A. Cuesta (UAB Barcelona)*

The origin and evolution of cooperation poses a riddle for evolutionary biologists, as selfish individuals maximizing their fitness and exploiting cooperative ones are expected to expand in the population and lead cooperation to extinction. However, it can be observed in nature and along human history that the existence of a common enemy, i.e. a third party which is harmful for all individuals, independently of their cooperative or defective behaviour, may induce an increase in the cooperative behaviour of the individuals under the threat or the destructive power of these agents. Here, we present a model in which, in addition to cooperators and defectors, we introduce Jokers, individuals following an indiscriminate damaging behaviour directed towards the public goods, or equivalently towards the participants of the common enterprises creating them. We show that the existence of such purely destructive individuals induces robust evolutionary cycles of cooperation, defection and destruction. We show that, in the presence of mutations, the cycles do not disappear, but represent the stable dynamical outcome. Furthermore, we show that these cycles happen for infinite as well as finite populations and for different updating methods, thus providing a mechanism for the emergence of cooperation in nature and human societies.
The importance of random effects in evolutionary games

Andre C. R. Martins & Renato Vicente (University of Sao Paulo)

Randomness is a part of the world and its effects on any systems where it is observed should ideally be well understood. In evolutionary games, as well as in other areas, it is usually considered that while randomness can introduce noise, its main effect should be just increasing the variance of the observed values. If there is no bias in the introduced noise, it would seem reasonable to assume that its main effects will cancel out. In this talk, I will show that random effects can actually cause the system to change its characteristics. By focusing on the snowdrift game, where the equilibrium states has cooperation coexisting with defection in the right proportions, the effects of introducing noise will be illustrated by studying the competition between a population consisting of pure cooperators, pure defectors and mixed strategists. Here, as the mixed strategists play each choice with probability equal to the equilibrium point, they can coexist with a mixture of cooperators and defectors and, once equilibrium is attained, no population has any advantage. However, by introducing random variations in the sizes of the populations, we will see that the pure strategists are led to extinction with the eventual victory of the mixed strategists. This effect is observed even for very small amounts of randomness. This shows that the coexistence, while a fixed point of the system with no noise, is not a stable solution when fluctuations are observed. This not only shows that mixed strategies might have a real advantage when the game does not favor one single pure strategy. It also illustrates the fact that introducing even simple unbiased noises in dynamic systems can have unexpected consequences.

Selective advantage of tolerant cultural traits in the Axelrod-Schelling model

Luis Mario Floria (University of Zaragoza)

The Axelrod-Schelling model incorporates into the original Axelrod’s model of cultural dissemination the possibility that cultural agents placed in culturally dissimilar environments move to other places, the strength of this mobility being controlled by an intolerance parameter. By allowing heterogeneity in the intolerance of cultural agents, and considering it as a cultural feature, i.e., susceptible of cultural transmission (thus breaking the original symmetry of Axelrod-Schelling dynamics), we address here the question of whether tolerant or intolerant traits are more likely to become dominant in the long-term cultural dynamics. Our results show that tolerant traits possess a clear selective advantage in the framework of the Axelrod-Schelling model. We show that the reason for this selective advantage is the development, as time evolves, of a positive correlation between the number of neighbors that an agent has in its environment and its tolerant character.

Invasion Dynamics in Iterative Games

Luis Alberto Martinez Vaquero (University Carlos III of Madrid)

Direct reciprocity is one of the most important mechanisms to promote cooperation. It acts when players interact repeatedly and thus emerges in iterative games. The aim of this work is to perform a systematic study of the emergence of responsive strategies in iterative games, as a result of successive invasions of resident strategies by new ones, which are incorporated to the game at a very low rate. For the sake of simplicity we have considered only the 16 pure strategies which opt to cooperate or defect depending on the actions of the two players in the previous round. Evolution proceeds through a replicator rule in a finite (albeit large) population. The result of the invasion process is a weighted and directed graph whose vertices are the different equilibria attained (either pure or mixed). The dominant strategies can then be
inferred from this graph. On the one hand, with this work we extend previous studies analysing the role of different strategies and their interactions in the Iterated Prisoner’s Dilemma game to a wide range of games, and on the other hand, we fully characterize the process by which the different strategies emerge and combine.

**The Cultural Evolution of Intergroup Conflict: Lessons from Evolutionary Game Theory**

*Matt Zimmerman (UC Davis)*

Large-scale human conflict is hard to explain with either classical or evolutionary game theory. This is because individuals are willing to die and further the welfare of other individuals, the vast majority of which are genetic non-relatives. Durkheim noted that this “altruistic suicide” was common in small-scale societies and present, though more rare, in large-scale societies. Recent models (Choi and Bowles 2007, Bowles 2009) suggest that a genetic predisposition for risky warfare could have started amongst closely related individuals in small scale societies. However, these models can not account for conflict amongst groups larger than a couple dozen individuals, let alone conflicts involving thousands or millions of individuals that have been common since the beginning of large-scale agricultural civilizations. Using an evolutionary game theoretic model, I argue that the dynamics of human cultural evolution and institutional organization explain the origins of altruistic suicide and its persistence in large groups much more easily than these simple genetic models. I also provide recent empirical evidence that support the conclusions of my model and suggests that these processes are important to understanding large-scale human conflict in the modern day.

**Evolutionary games defined at the network mesoscale: The Public Goods game**

*Jesus Gomez-Gardenes, Miguel Romance, Regino Criado, Daniele Vilone & Angel Sanchez (University of Zaragoza)*

The evolutionary dynamics of the Public Goods game addresses the emergence of cooperation within groups of individuals. However, the Public Goods game on large populations of interconnected individuals has been usually modeled without any knowledge about their group structure. In this paper, by focusing on collaboration networks, we show that it is possible to include the mesoscopic information about the structure of the real groups by means of a bipartite graph. We compare the results with the projected (coauthor) and the original bipartite graphs and show that cooperation is enhanced by the mesoscopic structure contained. We conclude by analyzing the influence of the size of the groups in the evolutionary success of cooperation.

**3.5 Session “Reputation / Signaling”**

**The Emergence of Reputation in Economic Transactions**

*Martin Abraham, Veronika Grimm, Christina Meyer & Michael Seebauer (University of Erlangen-Nurnberg)*

The impact of reputation in economic transactions has been studied as well in economics as in economic sociology. Reputation can be seen as a mechanism to overcome information problems many economic transactions are affiliated with. So far research on reputation has been focusing on reputation effects in particular, whereas the emergence of reputation in social networks has been widely neglected. This project aims at studying conditions which influence the emergence of reputation in absence of in-
institutionalized reputation mechanisms. To test our arguments we conducted a laboratory experiment. Subjects interacted repeatedly in trust games representing economic transactions. After the trust game each buyer had the possibility to pass on information about the transaction to one randomly chosen other buyer. In our treatments we vary the kind of information that may be communicated and the cost of information transmission. Results show that individuals are taking into account costs and benefits in their decision to pass on information. Furthermore the willingness to pass on information seems to be higher if people feel treated unfairly by the seller. The decision of information transfer is also influenced by interactions between buyers themselves: results show effects of direct reciprocity as well as effects of non-specific reciprocity in networks.

In-Group Favoritism Based on Tag and Reputation in Group

Yutaka Nakai (Shibaura Institute of Technology, Japan)

Regarding in-group favoritism, Tajfel, H., Billig, M. G., Bundy, R. P., and C. Flament (1971) found experimentally the fact that an in-group is distinguished from an out-group without a concrete reason and altruistic actions are taken toward in-group members. To show emergence of in-group favoritism theoretically, we define an in-group as a collection of players with the same tag as a formal symbol and a reputation as a player’s friendship measured by his past actions to an in-group. We introduced friend selection strategies based on such a tag and a reputation (FSS-TRG), and carried out evolutionary simulations on an artificial society of FSS-TRG players etc. As a result, we found four types of social states, one of which shows emergence of mutually hostile in-groups, in each of which in-group members are mutually friendly. Following the definition, a tag doesn’t have a practical meaning, so we could show that in-group favoritism can emerge adaptively without a concrete reason.

Is charitable giving a costly signal of cooperative intent? Decomposing the benefits of altruistic acts

Wojtek Przepiorka & Sebastian Fehrler (ETZ Zurich)

Different explanations have been given for the evolution of altruism in humans. It has been suggested, for instance, that altruistic acts are costly signals of an unobservable quality that makes a person more attractive for cooperative social interactions. Here we show that trustworthiness is a likely candidate for such a quality. Several authors have argued in a similar direction, but so far the literature lacks convincing empirical evidence. Our evidence from a computerized laboratory experiment shows that donors to charity are expected to be more trustworthy in social exchange than non-donors and that they are indeed more trustworthy. Moreover, our experimental design, combining an exchange game with a dictator game allows us to disentangle trust from other possible motives behind subjects’ responses to altruistic acts. We find that apart from trust, subjects’ endowments, indirect reciprocity and fairness considerations affect first movers’ transfers in the exchange game. Overall, our findings support a signaling explanation for the evolution of altruism.

Does category reporting increase donations to charity? A signalling game approach

Edward Cartwright & Amrish Patel (University of Gothenburg)

Many fundraisers report donations using categories such as more than 1000 pounds, more than 10,000 pounds etc. We question whether such category reporting increases donations using a signalling game framework in which the donation of a donor and perceptions of his generosity are determined endoge-
nously. We derive conditions such that category reporting will increase or decrease donations.

**The Viability of Fake Signaling and Cooperation in Structured Populations**

*Károly Takács & Andras Nemeth (Corvinus University of Budapest)*

On many occasions, cooperative motives can be signaled at a cost that is lower for cooperators than for defectors. As interests collide, however, there is no guarantee that a signaler has truly good intentions. We extend signaling theory to structured populations in which interactions take place within a spatial proximity. As cooperative intentions cannot be learnt for all possible interaction partners, signaling might also be important in these situations. We show that in the singleshot Prisoner’s Dilemma with a symmetric pre-play signaling option, under specific conditions, signaling and cooperation that is conditional on the signal received can survive. We demonstrate a likely occurrence of an evolutionary trap in which there are no cooperators and hence no benefits of signaling, but fake signalers still gain full dominance in the population. We find a non-linear effect of interaction and reproduction ranges on the evolutionary success of fake signaling. In addition, we highlight how mutation can maintain evolutionary cycles of unconditional defection, signaling with conditional cooperation, and fake signaling.

**A Nash bargaining model for simple exchange networks**

*Thomas Gautschi & Norman Braun (University of Mannheim)*

Starting from exogenously given negotiation networks, sociological exchange theories explain bilateral divisions of fixed surpluses (e.g., cake, dollar) as consequences of the partners’ structural embeddedness. In accordance with the available experimental evidence, we focus on simple exchange networks and present a formal model for predicting profit splits from such structures. In contrast to other approaches, we combine the generalized Nash bargaining solution from game theory with the assumption that both relational features and network positions affect exchange outcomes. The resulting point predictions for profit splits correspond closely with experimental results obtained by Cook et al., Lovaglia et al., Markovsky et al., Simpson and Willer, Skvoretz and Fararo, Skvoretz and Willer as well as Yamagishi et al.

**3.6 Session “Networks / Spatial Games”**

**Network Extension**

*Hans Haller (Virginia Tech)*

In a model of strategic network formation, the endogenously formed network is built around a pre-existing network. We envisage that the pre-existing or core network is publicly provided. Strategic network formation is decentralized: Players act in their private interest and bear the costs when adding links to the pre-existing network. We study how the pre-existing network affects existence of Nash equilibria and efficiency of Nash equilibrium outcomes.
Forming Opinions in Social Networks: The Effects of Strategic Interaction

Bernhard Buechel, Tim Hellmann & Stefan Kloessner (Saarland University)

Friday 9:30
CAB G61

We study a model of opinion formation based on repeated averaging (also known as DeGroot model). In contrast to the literature, we assume that opinions of other individuals cannot be observed, i.e. we introduce the possibility that agents are dishonest about their true opinion. Assuming that the agents-endowed with heterogeneous, but quadratic preferences-play a Nash equilibrium in every period, leads to a substantive extension of the classic DeGroot model. The opinion dynamics can be concisely expressed by a derived matrix, which corresponds to a network of social influence. Inspecting the eigenvalues enables us to study the following questions: Does dishonesty foster or hinder convergence of opinions (e.g. to consensus in a society)? How do the long-run opinions in a scenario of dishonesty differ from a scenario of honesty? Can dishonest behavior increase individual power (i.e. eigenvalue centrality)?

Does Oneness Explain Coordination? An Experimental Study on the Importance of Relationship Closeness for Coordination Success

Simon Gaechter, Chris Starmer & Fabio Tufano (Nottingham School of Economics)

Friday 10:00
CAB G61

A possible psychological determinant of coordination that has not, thus far, figured in economic (both experimental and theoretical) analysis of coordination games is the closeness of pre-existing social relationships between game participants. We empirically investigate the causal link between relationship closeness and coordination. Specifically, we observe behaviour in an experimental weak-link game while ‘manipulating’ and measuring the extent of relationship closeness that exists between the players in different groups. We develop an innovative research design characterized by (i) its focus on a problem of equilibrium selection in a coordination environment with multiple equilibria (i.e., the weak-link game), (ii) sampling and assignment strategies aimed to gather groups of participants exhibiting a large range of variation in relationship closeness, and by (iii) the introduction in an economic lab of the ‘oneness’ construct, which allows to measure and, thus, reinforce the control over the full range of relationship-closeness variation. In such a setting, after discounting individual characteristics, relationship closeness significantly increases coordination success. At higher closeness levels, not only Pareto-efficient equilibria are more easily secured but also ‘miscoordination’ (i.e., a failure in coordinating on anyone of the multiple equilibria) is reduced, due to improved action matching within groups. Finally, relationship closeness and the chances of a first ‘complete coordination failure’ (i.e., the reaching of the lowest Pareto-ranked equilibrium) straight after a sequence of better outcomes (usually referred as the ‘hazard rate’) appear inversely related: that is, the higher relationship closeness, the lower the hazard rate.

Embedding trust in information-exchange relations: A game-theoretic model for investments in and returns on social capital

Vincent Frey, Vincent Buskens & Werner Raub (Utrecht University)

Friday 10:45
CAB G61

Trust is an important lubricant of social and economic interaction. However, as research has established, trust depends strongly on the social structure in which the interacting actors are embedded. For instance, the embeddedness in dense networks of social relations through which reputations spread promotes trust and trustworthiness. In this theoretical study, we move beyond the examination of the benefits of embeddedness in exogenously given networks. We take into account that these benefits give actors incentives to strategically invest in their relations and we thus treat embeddedness as endogenous. Our aim is to
identify what conditions promote the formation of information-exchange relations as a mean to support trust and trustworthiness. To this end, we devise a game-theoretic model in which two trustors interact repeatedly with the same trustee. At the beginning of the game, one actor is chosen to decide whether to invest in an information-exchange relation between the two trustors for the whole game. We investigate analytically how the costs that the actors are willing to bear for establishing the relation depend on parameters describing the interaction situation. Our results show that a trustor’s willingness to invest in an information-exchange relation varies in a non-monotonic way with the severity of the trust problem. Starting from a moderate trust problem (i.e., a low potential loss due to abused trust or a high probability of interacting with a trustee who would never abuse trust), a trustor’s willingness to invest in a relation first increases and then decreases again as trust gets more problematic. This suggests that information-exchange relations are most likely to be formed in trust problems of intermediate severity. If it is the trustee who decides whether to invest in a relation, the decision also has the potential to reveal his incentives to abuse trust. This complicates the analysis which is not yet completely finished.

Prisoner’s Dilemma on a sizeable network: experiment and theory

Jelena Grujić, Constanza Fosco, Lourdes Araujo, Antonio Cabrales, Jose A. Cuesta & Angel Sanchez (University Carlos III of Madrid)

The mechanisms underlying the emergence of cooperation among unrelated individuals are as yet an unsolved puzzle. Many theoretical models have shown that the existence of structure in a population can help understanding the widespread emergence of cooperation, particularly in the framework of the Prisoner’s Dilemma (PD), but the results of these models largely depend on details such as the type of spatial structure or the evolutionary dynamics. Therefore, experimental work suitably designed to address this question is needed to probe these issues. We have performed an experiment to test the emergence of cooperation in the presence of an underlying structure [1]. Human subjects played a Prisoner’s Dilemma (PD) with each of their eight neighbors in a 13 x 13 square lattice taking only one action, either to cooperate (C) or to defect (D), the action being the same against all the opponents. We observed that the existence of a lattice giving structure to a population playing a PD does not lead to an increase of the cooperation level; the residual level is around 20% in experiments and has also been observed on 4 x 4 lattices [2]. Our findings also indicate that both heterogeneity and a “moody” conditional cooperation strategy, in which the probability of cooperating also depends on the player’s previous action, are required to understand the outcome of the experiment. In order to gain insight on the conclusions of the experiments from a theoretical viewpoint, we use replicator dynamics to describe the evolution of a set of strategies that mimics the observations, in a simplified context consisting of a well-mixed population of players confronted in iterated multi-player Prisoner’s Dilemma games [3]. We consider three strategies, namely cooperators, defectors and “moody” conditional cooperators, and four situations according to the number of players in the game, going from two to five. In all cases, the dynamics exhibits two attractors: one for a population consisting only of defectors, and an interior point with population frequencies comparable to those observed in the experiment. For the smallest groups, defection has a much smaller basin than the interior group, which therefore becomes the most probable evolutionary outcome. As the group size increases, defection becomes more probable. Our results are then discussed in view of the experimental results on the lattice and tested in a new set of experiments specifically designed to that end [4].

Interacting with several social partners decreases cooperation

Dirk Semmann & Katrin Fehl (University of Goettingen)

Human societies are structured in networks, for instance social networks on the internet who increasingly gain on fame. Within these networks we interact with a variety of social counterparts. Here, we investigate how the number of partners impacts cooperative behavior in the infinitely iterated prisoner’s dilemma (IPD). Half of the participants played a single IPD, which is the common setup. As a new feature, the other participants interacted in three IPDs at a time. Traditional evolutionary game theory assumes independence of games and thus no difference would be expected in the two social settings. Contrary to this assumption, we find a lower overall cooperation in the multiple-games treatment. In fact, these participants could only establish one cooperative relationship similar to the relationship of the single-game treatment, where cooperativity increased over time. Moreover, in one of the two remaining relationships the partner was treated very badly and even no increase in cooperativity was found. In addition, contradictory to previous findings participants did not rely on a win-stay lose-shift strategy; they used strategies similar to generous tit-for-tat.

3.7 Session “Inequality”

The Power of Both: Reciprocity and Social Status

Ulf Liebe & Andreas Tutic (University of Goettingen)

We provide evidence on the interplay of reciprocity and social status in the sequential dictator game. 618 nine-graders attending four distinct types of German schools participated in the paper-and-pencil experiments. The type of school attended by a pupil was used as a proxy for her social status. Studies on the interplay of other behavioral determinants than social status and reciprocity have shown that reciprocity tends to crowd out these influences. However, in our study it turns out that, although reciprocity is the most important determinant of behavior, it does not crowd out the effects of social status as observed in the simple dictator game: The higher the status of the dictator, the more she donates. The higher the status of the recipient, the less she receives in donations.

Solving Cooperation Problems in Heterogeneous Groups

Marc Keuschnigg & Jan Schikora (LMU Munich)

Voluntary contribution to public goods is recognized as a major driver of economic development. With a laboratory experiment conducted in Mangalore, India we show that cooperation levels in homogeneous and heterogeneous groups (with respect to religious affiliation) can be explained by the combination of anticipated reciprocity and conditional cooperation preferences. In particular, we test the functionality of ‘Leading by example’ as an institution to foster social order and resolve social dilemmas in the context of homogeneous and heterogeneous groups as to religious affiliation of its members. Using data from a questionnaire we explain the behavioral patterns of group leaders on the basis of demographic and opinion profiles.
The Public Loss Game - An experimental study of Public Bads

Stephan Schosser & Bodo Vogt (Karlsruhe Institute of Technologie)

In Iterated Public Good Games cooperation tends to be high during the first periods and decrease afterwards. Giving participants the possibility to punish others, inverts this effect and helps participants to ensure a cooperative outcome. In this work, we analyze the behavior of participants, who can contribute to a public good after they received a monetary loss. We find, that punishing behavior among participants is comparable to punishment in other studies. I.e., participants show both social and anti-social punishment to an extent predicted. In contrast to literature, contributions to the public good are initially higher in the loss case than when acting under gains, while they tend to decrease faster when punishment is not possible.

The Logic of Relative Frustration. Boudon’s Sociological Theory and Experimental Evidence

Joel Berger & Andreas Diekmann (University of Bern)

In the well known study "The American Soldier" Stouffer et al. (1965) reported the puzzling finding that soldiers were more dissatisfied with promotional opportunities in branches with high upward mobility than in branches with low mobility. A similar phenomenon is described by classical social scientists such as Tocqueville (1856) and Durkheim (1897): In times of economic growth, people become more dissatisfied even though chances for upward mobility are increasing.

In this study we present results from an empirical application of the game-theoretical model of relative deprivation proposed by Boudon (1979). The basic idea of the model is, that in case of few opportunities for promotion rational actors have low incentives to invest the necessary resources to compete for these opportunities. However, if opportunities rise, more and more actors will be tempted to enter the competition. Under certain conditions, the number of additional competitors grows much faster than the number of opportunities, so that there is a larger increase in the number of "frustrated" losers than in the number of "satisfied" winners. This results in a net loss in overall satisfaction compared to the situation with fewer opportunities.

We conducted a laboratory experiment to test Boudon’s model. The results reveal that real players invest more cautiously than expected. As a consequence, the rate of frustration remains constant if opportunities increase - a result that lies between the intuitive expectation of decreasing frustration and the model’s anticipated outcome of increasing frustration. To determine whether Boudon’s model cannot explain the phenomenon under study or the model conditions were not adequately replicated in our design, further experimentation is required.

Does Incentive Provision Increase the Quality of Peer Review? A Game-Theory Experimental Study

Giangiacomo Bravo, Flaminio Squazzoni & Karoly Takacs (University of Brescia)

Although peer review is crucial for innovation and experimental discoveries in science, it is poorly understood in scientific terms. Discovering its true dynamics and exploring adjustments which improve the commitment of everyone involved could benefit scientific development for all disciplines. In this talk, we report the results of a game-theory experiment developed to model peer review. The game was a modified version of the standard repeated investment game played by investors (journal editors), trustees (submission authors) and third parties (reviewers). Our aim was to examine one of the most important critical points for the quality and efficiency of peer review, i.e., incentive provision to increase
reviewers’ reliability. Our results demonstrate that offering material rewards to reviewers tends to decrease the quality and efficiency of the reviewing process, since rewards might undermine moral motives which guide reviewers’ behavior.

What kind of game is everyday interaction?

Hendrik Vollmer (University of Bielefeld)

Students of everyday life have been keeping their distance from game theory since Erving Goffman drew the line in "Strategic Interaction" (1969). Despite Goffman’s isolation of game theory as only addressing a very particular and generally somewhat exotic set of social situations, and despite a history of reciprocal neglect, a convergence of micro-sociological and game-theoretical perspectives is apparent in the understanding of coordination games first offered by Thomas C. Schelling, and then elaborated by David Lewis and, more recently, by Brian Skyrms and Herbert Clark, among others. I demonstrate the general compatibility of the Schelling-Lewis understanding of coordination games with Erving Goffman’s understanding of the interaction order and the process of framing, and I discuss a couple of specifications called for in applying this perspective to the run of everyday interaction. Everyday interaction is understood as a coordination game with multiple equilibria which participants select by reiterated signaling. There is an empirical tendency among participants to generally affirm one another’s signals in everyday interaction, but there is also the possibility of transforming coordination problems in ways introducing restrictions on both signaling and the selection of Nash equilibria.

3.8 Poster Session

An Intuitive Interpretation of Player’s Behavior in Multi-choice Games When the Shapley Value is Adopted

Wen-Lin Chiou & Chih-Ru Hsiao (Fu-Jen University, Taiwan)

Hsiao and Raghavan (1992, 1993) extended the traditional cooperative TU game to a multi-choice cooperative game and extended the traditional Shapley value to a multi-choice Shapley value. Other researchers call the multi-choice Shapley value the H&R Shapley value. The H&R Shapley value is closely related to the cost $w(j)$ (including opportunity cost) of executing the action $a_j$. Intuitively the cost of a higher level action is higher, i.e. $w(j) = w(k)$ whenever $j < k$. Naturally, a player’s behavior in a multi-choice game depends on the cost of executing an action, the characteristic function and the solution of the game, i.e. depends on how much one should pay for playing the game, how much they can jointly get from playing the game and how they share the rewards. In this talk we will give an intuitive interpretation of player’s behavior when the H&R Shapley value is chosen as the solution of a multi-choice game. Furthermore, since P&Z Shapley value proposed by Peters and Zank (2005) and the symmetric form of the H&R Shapley value studied by Hwang and Liao (2009) are special cases of the H&R Shapley, we will give an interpretation for those values as well. We will also check the intuitive meaning of the D&P Shapley value proposed by Derks and Peters (1992) and give an open question.

Co-evolution of behaviour and social network structure promotes human cooperation

Katrin Fehl (University of Goettingen)

The ubiquity of cooperation in nature is puzzling because cooperators can be exploited by defectors. Recent theoretical work shows that if dynamic networks define interactions between individuals, coop-
eration is favoured by natural selection. To address this, we compare cooperative behaviour in multiple but independent repeated games between participants in static and dynamic networks. In the latter, participants could break their links after each social interaction. As predicted, we find higher levels of cooperation in dynamic networks. Through biased link breaking (i.e. to defectors) participants affected their social environment. We show that this link-breaking behaviour leads to substantial network clustering and we find primarily cooperators within these clusters. This assortment is remarkable because it occurred on top of behavioural assortment through direct reciprocity and beyond the perception of participants, and represents a self-organized pattern. Our results highlight the importance of the interaction between ecological context and selective pressures on cooperation.

Inequality and Behavior. An Invisible-hand Game Experiment with Asymmetric Payoffs

Juergen Fleiss & Ulrike Leopold-Wildburger (University of Graz)

Inequality is a central concept and is studied by various social sciences and by economics. Sociologists traditionally focus on the description of inequality in a society and on the study of mechanisms reproducing it. Experimental economists study inequality and its effects on human behavior in a controlled environment. Laboratory experiments have shown that fairness is an important factor in explaining behavior. A number of theories of fairness have been developed (Falk et al. 2008). We will present a new experimental design to study the effects inequity-aversion. The design of the experiment is based on the rarely used invisible hand game (IHG) (Bowles 2006). An IHG has one Nash equilibrium which is Pareto optimal. If both players maximize their own payoff they also achieve the best possible social result. There is no social dilemma. An example of a payoff-matrix can be found in Table 1. [Payoff Tables omitted here]

Inequity-aversion is often studied using the Ultimatum game in which one of the players introduces asymmetric payoffs with his proposal. The new idea here is to introduce the inequality externally in the design. Thus in our experiment the inequality is not caused by one of the interacting players. To our knowledge this has not been studied before. We modify the IHG by introducing asymmetric payoffs in the equilibrium. Examples for different treatments can also be found in Table 1. We conduct experiments where participants are interacting anonymously with a partner. One-shot treatments as well as sessions over several rounds are intended. A player is randomly matched with another player. One of the players receives the high equilibrium payoff, the other one the low equilibrium payoff. Subjects are aware of their partners’ higher or lower payoff. The distribution of points in the equilibrium should be perceived as unfair by the players. The roles are allocated randomly and no reason is given why one of the players should receive a higher payoff than the other (see also Fehr and Schmidt 1999, Fehr and Fischbacher 2004). Subjects are informed that their monetary compensation depends on the number of points they earn in the experiment.

Keeping climate in check: A self-enforcing strategy for cooperation in public good games

Jobst Heizig (Podsdam Institute for Climate Impact Research)

As the Copenhagen Accord indicates, most of the international community agrees that global mean temperature should not be allowed to rise more than two degrees Celsius above pre-industrial levels to avoid unacceptable damages from climate change. The scientific evidence distilled in the IPCC’s 4th Assessment Report shows that this can only be achieved by vast reductions of greenhouse gas (GHG) emissions.

Still, international cooperation on GHG emissions reductions suffers from incentives to free-ride and to renegotiate agreements in case of non-compliance, and the same is true for other so-called ‘public
good games.’ We show how one might overcome these problems with a simple dynamic strategy of Linear Compensation (LinC) when the parameters of the problem fulfill some general conditions including equal marginal costs and an unbounded payoff function.

The proposed strategy redistributes liabilities according to past compliance levels in a proportionate and timely way. It can be used to implement any given allocation of target contributions, and we prove that it has several strong stability properties. In particular, the strategy is strongly renegotiation-proof and a Pareto-efficient strong Nash equilibrium in each subgame.

**Modeling a Multi-choice Cooperative Game Based on the Law on Equal Job Opportunities**

*Chih-Ru Hsiao & Wen-Lin Chiou (Soochow University, Taiwan)*

The H&R Shapley value defined by Hsiao and Raghavan for multi-choice cooperative game is redundant free. If the H&R Shapley value is used as the solution of a game, there won’t be any objection to a player’s taking redundant actions. Therefore, the spirit of the law on equal job opportunities is automatically fulfilled. Also, if the H&R Shapley value is used as the solution of a game, it makes no difference to the players whether they have the same number of options or not. Moreover, the D&P Shapley value, the P&Z Shapley value and the WAC value are linear combinations of the H&R Shapley value, hence, they have all the same dummy free properties and the independent property as does the H&R Shapley value. Finally the N&P Shapley value is not redundant free.

**Group Based Regret and Collective Action**

*Thomas Jensen (University of Copenhagen)*

The outcome of the 2000 US presidential election was decided when Bush was certified as the winner in Florida. His official margin of victory was 537 votes. Consider a potential voter in Florida who preferred Gore over Bush but for some reason did not vote. What was her state of mind when it became clear that Bush had won the election? Did she regret not voting? If regret is rational in the sense that an individual only feels regret if she could personally have improved the outcome by choosing differently then the answer is no. Even though Bush’s margin of victory in Florida was remarkably slim, one extra vote for Gore would not have changed the outcome. However, it is not given that the feeling of regret is so closely linked to the observation of whether she could personally have changed the outcome. In this paper we hypothesize that an individual feels regret after a realized outcome of a collective action situation if she and other people with similar preferences could have changed the outcome. If that is true then the voter would have felt regret because she and just 537 other abstaining Gore supporters in Florida could have given Gore the victory by turning out to vote. We investigate by game theoretic modeling the effect of regret in collective action situations when regret is group based in the sense described above and anticipated by the agents. Among the situations considered are voting and the provision of a binary public good. It is shown that, compared to standard rational choice theory, the introduction of group based regret leads to more participation/contribution.

**Queueing problems in service management: game-theoretic model**

*Melnikova Ekaterina (St-Petersburg State University)*

A set of agents with different waiting costs are waiting to get a service. Since agents can’t be served simultaneously it’s required to queue them. It is important that each agent, who had to wait, has to incurs losses because of downtime. This brings us to the problem of organizing an optimal queue in the sense
of minimum total waiting costs for all agents and setting compensation payments for waiters. Each agent is characterized by his waiting cost. The payoff of an agent is equal to compensation payment for him minus total waiting costs during his downtime. Solution of the problem that satisfies Pareto-efficiency and fairness conditions with respect to agents having equal waiting costs is searched using cooperative game theory approach and Shapley Value. The characteristic function used for the computation of the Shapley Value sets maximum guaranteed payoff of coalition through placing it to the end of the queue in optimal order.

Experimental Results on Recommendation Behavior of Consumers and Managers and the Impact on Product Choice

Miriam Mezger (Universitaet zu Koeln)

Consumer recommendations can mitigate the problem of asymmetric information in product choice. We introduce a model of an online consumer recommendation site, in which information on product quality can be passed from one consumer to the next. We have reason to believe that companies integrate recommendations into their marketing strategies. Therefore, our model also allows managers to provide recommendations for products. All recommendations are anonymous. This raises the question, whether consumers may trust them and use them for their product choices.

Our game theoretic analysis shows that no recommendation should be observed in the game. Yet, in our experiment, we find a substantial prevalence of recommendation behavior, even though providing information is costly. On the internet, we can hardly verify the proportion of recommendations provided by managers and consumers. However, with our experimental design we can analyze the number of ratings provided by each consumer and each manager.

In our experiment we observe that recommendations are significantly more often provided by managers than by consumers. We do not find a significant difference in the number of recommendations provided by the two managers. However, the number for own products is significantly higher than the number of recommendations for the competitor’s products. When considering the quality of products we find significantly more recommendations than expected for own products with best quality under a uniform distribution of recommendations for all quality levels and significantly less recommendations for the competitor’s products with worst quality. Furthermore, we observe that managers provide the highest number of recommendations for the products of the competitor, if the product is of equal quality to their own product. The number is second highest for the case that the product of the competitor is of better quality than their own product and lowest for the case that the competitor’s product is of worse quality than their own.

While only a fourth of all recommendations provided by managers reflect the quality of the products, the ratings provided by consumers are generally truthful and hence valuable for their peers. Since recommendations by managers outnumber those by consumers in our experiment, the question arises, whether recommendations can provide the consumers with any useful information for making optimal product choices.

We find that the majority of consumers consults the ratings and relies on the recommendations that they observe when making their product choices. The recommendations may both positively and negatively influence the percentages of optimal choices made by the consumers. However, the larger of the two effects is in the direction of more optimal choices. Recommendations may therefore be assumed to support the consumers. While the consumers benefit from the recommendations, managers lose and the loss of the managers outweighs the benefit of the consumers in terms of payoff. This result shows that there is need for improvements of recommendation models in order to enhance the efficiency of the market outcome.
Budgeting and Performance Evaluation - nothing but lies?

Arleta Mietek & Ulrike Leopold-Wildburger (University of Graz)

Budgetory reporting and the budgeting process are important issues in management accounting (Brown, Evens & Moser 2009). Reporting facilitates the ow of information within an organization. Due to the budgeting the information asymmetry between upper and lower management can be offset. The (generally) better informed local management communicates its information to the upper management, which can be further used by the last for planning, resource allocation and coordination in the organization and also for performance measurement (eg. Ewert & Wagenhofer 2005).

And exactly that last use of budgets caused and still causes many discussions. Some authors (e.g. Jensen 2003 or Hansen et al. 2003) criticize the missing reasonability of using budgets for performance evaluation because of its incentives to misrepresentation of information. Agency theory, however, assumes a rational agent who reports dishonestly.

In our experimental study we examine the effects of (face-to-face) communication and the degree of acquaintance/social contacts between the parties on reporting behavior. One can interpret the communication and the degree of acquaintance as some characteristics of an organization. With the help of experimental studies we hope to find the influence of different types of organization structure on honesty in reporting. Our hypotheses are: (i) In organizations with high level of communication the preference for honesty in reporting is significantly higher than in organizations with low level of communication. (ii) In addition, the higher degree of acquaintance between parties also increases the honesty in reporting.

Furthermore, we are interested in the following connections: (i) relation between honesty in managerial reporting and social preferences and (ii) relation between honesty in managerial reporting and personality characteristics of interacting parties, respectively. For this purpose we use the ring measure of social values (Liebrand 1984, Liebrand and McClintock 1988).

Further treatments could refer to the influence of social pressure on honesty in reporting. In particular, we conduct a laboratory experiment in which there are two parties: the supervisor or principal (upper manager) and the better informed subordinate or agent (lower manager). The agent has a private, perfect information and shall report it to the supervisor. Whereupon, the subordinate’s compensation depends both on the reached revenue and the reported revenue. The parameters are set this way, that the subordinate gets the highest payoff by reporting the possibly lowest revenue, which means the highest level of misrepresentation.

Opinion Spreading in Social Networks: 0-1-2 Model

Igor Kanovsky & Omer Yaary (Emek Yezreel College, Israel)

Modern social interaction is rapidly moving towards the virtual social networks. Computerized networking infrastructure enables us to monitor and analyze information spreading, innovation diffusion and opinion formation in social networks. This stimulates attempts for a deep understanding and modeling of networked social process.

There are two main approaches for modeling idea spreading. The infection approach assumes that in each contact between actors with some probability the opinion will spared on. The threshold approach assumes that the probability of opinion spreading dramatically increases when is reached a certain fraction of opinioned neighbors.

In both approaches presented above, there isn’t a significant difference in the opinion spreading time by different actors as a starting point, which contradicts sociology theories according to which there are key actors in social environments, called influencers. For this reason we proposed a new model, which capture the main difference between information and opinion spreading.
In information spreading additional exposure to certain information has a small effect. Contrary, when an actor is exposed to 2 opinioned actors the probability to adopt the opinion is significant higher than in the case of contact with one such actor (called by J. Kleinberg "the 0-1-2 effect"). In each time step for each actor that does not have an opinion, we randomly choose 2 of his network neighbors. If one of them has an opinion, the actor obtains opinion with some low probability, if two - with a higher probability.

Opinion spreading was simulated on different real world social networks (network of e-mail contacts, network of scientific citation) and similar random scale-free networks. In each simulation we defined a starting actor (whom which will influence the network) and the number of actors with opinion by time line was measured.

The behavior of the spreading is characterized by a slow incline, until reaching a critical point (or tipping point on time line, $t_p$) after that the spreading speed is dramatically increasing. Without the 0-1-2 effect (when the probability to adopt the opinion from one or two friends is approximately the same) the form of time dependence curve is similar to the one with 0-1-2 effect, however $t_p$ value is significantly larger.

The simulation results show that after reaching $t_p$ the spreading in the network is independent on the starting actor, but the value of $t_p$ is strongly dependent on starting actor. $t_p$ is not depended with the number of friends of starting actor. They show that the best influencer actor has a significant number of friends, however not all actors with large number of friends are good influencers.

In order to understand our result, we randomized the social networks by rewriting the links randomly while preserving the number of friends of each actor. In the randomized social network the significant difference between $t_p$ for different starting actors disappear. As well as $t_p$ value in this case is big and comparable with the no 0-1-2 effect case.

Some social networks properties have to be accounted for further analysis. Social network has a power low distribution of actor degree (degrees of an actor is number of friends he has). The power low network has is characterized by a small number of "stars" actors with big degree, and the vast majority are actors with small degree. Social networks fit the Small World definition that means a short average distance between actors with a big clustering coefficient (CC, fraction of the actor friends which are friends with each other). For example a celebrity will have a low value of CC, while core community person will have a high value of CC. In the case of 0-1-2 effect, the influencer is an actor whom has a high value of CC. It is known, that around actors who are stars there is a gathering of eclectic people who are following the stars, for that reason the CC value of stars is low. As a result not the stars are influencers.

In our randomization process the Small World property is destroyed, but the stars continue to be stars as regarding to their degree. Simulation shows that influencers does not exist in this case, this points that influencer can exist only in Small World networks. Actually it means that the tipping point for network without Small World topology is not reachable.

Known characteristics of an actor in a network can not indicate if he is a potential influencer. It’s clear that an influencer must not have a low degree and must have a high CC value. To be an influencer a special position of actor in the network is needed and this position is not a local property of the actor. Further investigations will be concentrated on accurate definition of this position together with introducing of new topological metrics of a network.

Replicator Dynamics Analysis of Risk Choice Game

Isamu Okada & Hitoshi Yamamoto (Soka University, Japan)

If you could freely choose the degree of risk, which would you choose in order to gain a competitive advantage? This open question is applicable to a wide range of fields such as evolutionary biology,
sociology, management science, politics, and economics. Roos et al. (2010a,b) conducted a pioneering work on state-dependent risk preferences and showed that a specific risk preference is adaptive, and this fact is consistent with prospect theory. However, their analyses are limited and cannot provide behavioral economics with rich theoretical hypotheses, which suggests that they did not formulate the risk choice behavior properly. We present a mathematical analysis and a simulation analysis of a replicator dynamics equation on strategies for risk choice behavior by describing them properly. We can provide new insight to this open question by analyzing our model. We use an alpha lottery, which can define the infinite heterogeneity of the degree of risk to describe a risk choice game. By devising an arrangement of strategies, we developed a notation for the strategies of risk choice behavior with sequentiality. Using this notation, we can analyze risk choice strategy with up to second-order sequentiality mathematically properly. In order to treat risk choice strategy with third-order or more sequentiality, we formulated a replicator dynamics equation, proved some theorems, and derived several salient insights for the stability of the dynamics of strategies. Moreover, we identified dominant strategies of a risk choice game with up to fifth-order sequentiality through numerical simulations. We provide new hypotheses for some theories that were developed by using actual case studies and behavioral economics.

As a result of analysis, it is clear that an expectation vector must be asymmetric when relative merits exist among risk choice behaviors. We clarified that applying sequentiality is a necessary condition for establishing patterns where the expectation vector is asymmetric. Second, we defined some concepts to properly discuss the relative merits of strategies and compared strategies in first- and second-order games. As a result, we clarified that there exists a quasi-perfect dominant strategy in the second-order game. No strategy which is either dominant or equal to all the other strategies exists in a third- or more order game, and therefore the analytical approach explained the above limits. We then carried out replicator dynamics analysis. As a result, we verified that in the dynamics without perturbation (there is no new entry strategy by any invading mutant) some of the strategies survive while the remainders go extinct. Further, the equilibrium point is just neutral stable and is not a vacuum, and so the population of the surviving persistent strategies encircles the vortex point. We also proved that the dynamics with perturbation in which a mutation is installed are globally asymptotically stable to a unique equilibrium point for any initial population. Discussing the features of strategies that are divided into persistent or not would make a very interesting future study. Finally, we did numerical simulations to specifically solve the persistence issue. As a result, we identified the persistent strategies in the third- to fifth-order games.

Our model might be compared with the prisoner’s dilemma model because both models have an extremely high degree of abstractness and therefore have many applicable fields. We treated risk choice behavior as a highly abstract model and discussed several basic ideas for applying the model in this paper. It is expected that this model can be adopted not only in the field of behavioral economics but also in ecology, sociology, consumer behavioral theory, and a wide range of other areas in the future.

**Evolution of cooperation by defection in the metanorms game**

*Hitoshi Yamamoto (Rissho University, Japan) & Isamu Okada (Soka University, Japan) (Rissho University, Japan)*

The metanorms game is a well-known model for maintaining norms in a group [1]. As an extension of the n-person prisoner’s dilemma, it is an excellent model for studying how to maintain norms in a non-centralized group as in problems dealing with international cooperation. It has been pointed out, however, that the parameter space in which metanorms can stabilize cooperation is limited. We conducted simulations experiments to search out conditions for which metanorms can stabilize cooperation and showed that cooperation collapses in many parameter environments.
We introduce a "social vaccine" as a means of robustly maintaining cooperation. In general, a vaccine is a weakened pathogen that is injected into a human body to create antibodies and ward off infection by that pathogen. Similarly, a social vaccine with respect to a group refers to the injection of a small number of agents that are always defecting to achieve an effect whereby norms are highly maintained throughout the group. When introducing a social vaccine, we found, for the norms game, that defection was still dominant but, for the metanorms game, that cooperation could be maintained in a stable manner even when varying the parameter space.

The collapse of metanorms without a social vaccine can be explained as follows. If agents with low vengefulness were to penetrate a group in which cooperation has been established, the lack of defecting behavior would prevent such behavior from being discovered enabling agents with low vengefulness to spread throughout the group. If vaccine agents were to be introduced, however, agents with low vengefulness could easily be discovered thereby preventing a drop in the group’s overall degree of vengefulness.

We also investigated the stability of norms when setting the strategy \((B, V)\) of the social vaccine to \((0, 0)\), \((1, 0)\), \((0, 1)\), and \((1, 1)\). Results are shown in Table 1. "B" means the probability that the player will defect, and "V" means the probability the probability that the player will punish someone who is defecting.

| Table omitted |

These results show that cooperation stabilizes in any of the above strategies other than the one in which agents who are cooperative but tolerant to defection are introduced, that is, where \((B, V) = (0, 0)\). On investigating where the evolutionarily stable strategy (ESS) exists in each of the above strategies, we obtained the following results. For the \((0, 0)\) strategy, the behavior of the entire group is practically the same as the basic metanorms game and cooperation collapses. For the \((1, 0)\) and \((1, 1)\) strategies, there is only a single stability point for stability in cooperation under dynamical conditions with the result that cooperation is robustly stable. However, for the \((0, 1)\) strategy, there are two stability points corresponding to cooperative strategy and non-cooperative strategy under dynamical conditions, and although unstable, a transition to non-cooperation occurs only under extremely rare conditions with the result that cooperation is maintained.

Lotem et al. [2] have proposed a similar idea in which phenotypic defectors who are always defecting are introduced in a one-to-one indirect reciprocity game in an environment where image scoring has been introduced. In our research, the application scope of the social vaccine to the metanorms game is wide; it can be used, for example, to compare the effects of punishment and defection and to discuss the range of influence of metanorms in a society with \(n \times n\) mutual interaction.
## 4 Participant List

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5  Conference Dinner

We will be having the conference dinner on a boat while cruising on the Zürichsee. The cruise starts on Thursday 7:30 pm from Bürkliplatz. Take Tram 9 in direction Triemli. The ride takes about 10 minutes. You will find a one-way ticket to Bürkliplatz in your delegates pack. Please be at the landing-stage at least 10 minutes before the ship casts off. The round trip takes three hours and the boat will return to Bürkliplatz at 10:30 pm.

6  Lunch

We have reserved seats in the foodLab, the mensa in the CAB building, but you can go to any mensa on the campus (cp. map of the conference venue) or to one of several restaurants at Universitätstrasse. FoodLab serves European and Asian cuisine, especially fresh homemade pasta. Please indicate that you are a guest. Lunches will be at your own expense and cost about CHF 14.

Link / Menu: http://www.gastro.ethz.ch/locations/eth_zentrum/rest_cab/index_EN

7  WLAN

Access credentials for the ETH WLAN can be found in the delegates pack.
8 Conference Venue

Plenary sessions will take place in the ETH main building (HG) in the rooms Aula (G60) and Audimax (F30). Parallel sessions and the poster sessions will be in the CAB building, room G11, G61, G59, and G10.5.
9 Notes