Immanuel Bomze, University of Vienna
Title: Aiding cognition in complex structures

Abstract: This presentation is based upon several collaborative (partially ongoing) research works with A.P. Duarte Silva, M. Kahr, M. Leitner, F. Maggioni, F. Rinaldi, S. Rota-Bulo, W. Schachinger, and R.Ullrich. By analogy to immunization processes in nature, a mathematical paradigm linking biology, game theory, and efficient clustering and/or classification algorithms will be presented which already was successfully applied to several big data analysis problems in image processing and pattern recognition. This paradigm provides a machine-assisted guide to structure (re-)cognition in massive data which are difficult to detect by bare eye (or paper and pencil). The novel application to robust dominant-set-clustering in social networks presented here may enable fresh views on mass action phenomena.

Joanna J. Bryson, University of Bath & Princeton University
Title: Generating Publics for your Goods Investment: Trust, Inequality, and Polarization

Abstract: Cooperation is often viewed as an unlimited good, but then why do we need to put on our own oxygen mask before assisting others? In fact, each individual must budget their investment capacities between many possible opportunities, which must on average include sufficient individual investment to maintain group survival. What if this requires changing the size or the nature of the group? In this talk I will describe at least two sets of ongoing research:

1. With Karolina Sylwester, Benedikt Herrmann, Simon Powers and Will Lowe, I am working on accounting for cultural variation by global region in cooperation as measured experimentally using the public goods game, with a special focus on accounting for anti-social punishment. Anti-Social Punishment is the costly punishment of those who contribute to the punisher's own good.
2. With Nolan McCarty and Alex J Stewart, I am extending these models to account for political polarization and why it correlates with income inequality.
3. If time permits, I will also describe work with Paul Rauwolf on public trust and the social communication of information.
4. Either way, I conclude with a brief discussion of some implications for this work on the question of how artificial intelligence (AI) may be impacting our society.

Noam Brown, Carnegie Mellon University

Title: Libratus: Beating Top Pros in No-Limit Poker

Abstract: Poker has been a challenge problem in AI and game theory for decades. As a game of imperfect information, poker involves obstacles not present in games like chess or Go. No program has been able to beat top professionals in large poker games, until now. In January 2017, our AI Libratus decisively defeated a team of the top professional players in heads-up no-limit Texas Hold'em. Libratus features a number of innovations which form a new approach to AI for imperfect-information games. The algorithms are domain-independent and can be applied to a variety of strategic interactions involving hidden information. This is joint work with Tuomas Sandholm.

Iain Couzin, Max Planck Institute for Ornithology & University of Konstanz
Title: Collective Sensing and Decision-Making in Animal Groups: From Fish Schools to Primate Societies

Abstract: Understanding how social influence shapes biological processes a central challenge in contemporary science is, essential for achieving progress in a variety of fields ranging from the organization and evolution of coordinated collective action among cells, or animals, to the dynamics of information exchange in human societies. Using an integrated experimental and theoretical approach I will address how, and why, animals exhibit highly-coordinated collective behavior. I will demonstrate new imaging and virtual reality (VR) technology that allows us to reconstruct (automatically) the dynamic, time-varying sensory networks by which social influence propagates in groups. This allows us to identify, for any instant in time, the most socially-influential individuals, and to predict the magnitude of complex behavioral cascades within groups before they actually occur. By investigating the coupling between spatial and information dynamics in groups we reveal that emergent problem solving is the predominant mechanism by which mobile groups sense and respond to complex environmental gradients. Finally, I will reveal the critical role uninformed, or unbiased, individuals play in effecting fast and democratic consensus decision-making in collectives, and will test these predictions with experiments involving schooling fish and wild baboons.

Audrey Dussutour, CNRS University Toulouse III
Title: Habituation in non neural organisms, evidence from slime molds

Abstract: Learning, defined as a change in behavior evoked by experience, has hitherto been investigated almost exclusively in multicellular neural organisms. Evidence for learning in non-neural multicellular organisms is scant and only a few unequivocal reports of learning have been described in single celled organisms. In this conference, in a first part, I will attempt to demonstrate habituation, a simple form of learning, in a unicellular organism Physarum polycephalum. In a second part of this conference, I will show that habituation can be transferred from one cell to another via cell fusion. In a last part, I will present a potential mechanism responsible for habituation in slime molds. All these results suggest that slime moulds may be an ideal model system in which to investigate fundamental mechanisms underlying the ground-floor of learning abilities. Besides, documenting habituation in non-neural organisms such as slime moulds is centrally important to a comprehensive, phylogenetic understanding of when and where in the tree of life the earliest manifestations of habituation evolved.

Yuval Heller, Bar-Ilan University - Erik Mohlin, Lund University
Title: Observations on Cooperation: Theory and Experiment (Yuval Heller & Erik Mohlin).

Abstract: We study environments in which agents are randomly matched to play a Prisoner's Dilemma, and each player observes a few of the partner's past actions against previous opponents. We depart from the existing related literature by allowing a small fraction of the population to be commitment types. We present a novel intuitive combination of strategies that sustains cooperation in various environments. Moreover, we show that under an additional assumption of stationarity, this combination of strategies is essentially the unique mechanism to support full cooperation, and it is robust to various perturbations. Next, we extend the results to a setup in which agents also observe actions played by past opponents against the current partner. Finally, we design an experiment to test our theoretical predictions.

Cecilia Heyes, University of Oxford

Title: Cognitive Gadgets: The Cultural Evolution of Thinking

Abstract: Evolutionary psychology casts the human mind as a collection of cognitive instincts - organs of thought shaped by genetic evolution and constrained by the needs of our Stone Age ancestors. This picture was plausible 25 years ago but, I argue, it no longer fits the facts. Research in psychology and neuroscience - involving nonhuman animals, infants and adult humans - now suggests that genetic evolution has merely tweaked the human mind, making us more friendly than our pre-human ancestors, more attentive to other agents, and giving us souped-up, general-purpose mechanisms of learning, memory and control. Using these resources, our special-purpose organs of thought are built in the course of development through social interaction. They are products of cultural rather than genetic evolution, cognitive gadgets rather than cognitive instincts.

Peter Gärdenfors, Lund University

Title: Word meanings as correlated equilibria in conceptual spaces

Abstract: Cognitively oriented theories of semantics argue that word meanings are mental representations and not entities in the world (as realist theories claim). A general problem for the cognitive approach is how we can know how we mean the same thing when we use a word. A particular problem concerns the meaning of words that refer to fictional entities. I argue that given that our mental structures have certain geometric and topological properties, common meanings can be identified as correlated equilibria in conceptual spaces. This will be illustrated by results from simulations of coordination games, but also from more general theoretical principles. The mechanism will be illustrated by an analysis of Geach's problem of intentional identity.

Alex Kacelnik, University of Oxford
Title: Choosing between models of choice: how and when are preferences constructed?

Abstract: I will contrast two putative mechanisms of choice, and examine their empirical validation with several animal experiments. One modeling strategy (Tug-of-War, ToW) is to focus on simultaneous choices, namely how behavior is allocated when two actions with known stochastic outcomes are available. In humans, and possibly other species, preferences can be altered by the way in which the alternatives are framed, in some cases leading to a reversal of options' ranking. It has been argued that such empirical observations preclude compliance to any normative interpretation, and that preference must be constructed at the time and in the context of choice. In contrast, the Sequential choice Model (SCM), which derives from the optimal foraging literature in behavioural ecology, argues that choice mechanisms evolve to be efficient in sequential encounters. In such encounters only one option is present and agents balance acting towards it versus continuing searching. The potential benefits of allocating behavior to each option should then be valued against the lost opportunity it causes. Simultaneous choices do occur however (especially in our designed experiments), and these two strategies make contrasting predictions. The SCM states that in simultaneous choices action is allocated by a simple horse race, in which only the faster alternative is expressed. In this view, options in a choice set are processed in parallel, there is no cognitive construction of preference during the choice, there is no cognitive cost of choosing, and behavior in sequential encounters is a strong predictor of choice allocation. I'll review experiments in birds and rats that, on the whole, suggest that the SCM is a better descriptor of available data.

Marc Mézard, ENS Paris Sud University
Title: Rationality limited by nature: a few lessons from statistical physics

Abstract: This talk will address the limitations of rationality due to the physical and mathematical nature of economic and cognitive facts. Statistical physics has taught us that "More is different", in the sense that collective behaviors emerging from the interaction of many actors give rise to new, and often unexpected phenomena like phase transitions. These effects can appear in cognitive tasks as well as in situations of many interacting agents, and provide intrinsic limitations to "rational" behaviors.

Arthur Robson, Simon Fraser University
Title: Adaptive Hedonic Utility

Abstract: Recent research in neuroscience provides a foundation for a von Neumann Morgenstern utility function that is both hedonic and adaptive. We model such adaptation as arising from a limited capacity to make fine distinctions, where the utility functions adapt in real time. For minimizing the probability of error, an optimal mechanism is particularly simple. For maximizing expected fitness, a still simple mechanism is approximately optimal. The model predicts the S-shaped utility characteristic of prospect theory. It also predicts that risk aversion or risk preference will remain evident over low stakes, resolving a vexing puzzle concerning experiments.

Ariel Rubinstein, Tel Aviv University
Title: Multi-dimensional Reasoning in Games: Framework, Equilibrium and Applications*

Abstract: We develop a framework for analyzing multi-dimensional reasoning in strategic interactions, motivated by the following experimental findings: (a) in games with a large and complex space of strategies, players tend to think in terms of strategy characteristics rather than the strategies themselves, and (b) in choosing between strategies with a number of characteristics, players consider one characteristic at a time. The solution concept captures Nash-like stability of a choice of features of strategies rather than of strategies. The concept is applied to a number of economic interactions, where stable modes of behavior are identified.

Aldo Rustichini, University of Minnesota
Title: Biological foundations of Choice and Memory

Abstract: In real-life situations, most choices are among options considered sequentially, so a memory trace of the value associated with the options already met must be stored until all options have been considered. Thus, memory and choice are essentially linked. This feature is missing in typical experimental setups where choices among options are simultaneously available to the decision maker.

We study theoretically and experimentally the role of working memory in choice, relying on a new design where participants see two options separated by a time delay of short random length, and choose after the two options are presented again simultaneously. We found that the option presented first is, everything else being equal, significantly and substantially less likely to be chosen. We show that this behavioral effect has a natural explanation in the information and choice process that brain imaging analysis reveals: the value of the first option is stored in a leaky working memory system in posterior parietal regions. When the second option is presented, its value is encoded in ventro-medial Pre-Frontal Cortex, while the value of the first option is recalled, with a reduction of value following the leak, and comparison of the two produces the selection of one of the two options. We provide a formal, neurally based model of the storage of memory value and of choice, providing a link between classical and neurally based decision theory.