SOE 10: Social Systems, Opinion and Group Dynamics I

Time: Tuesday 14:00–15:30 Location: H 0110

SOE 10.1 Tue 14:00 H 0110

The Wisdom of Crowds Effect at Work: The Good, The Bad, and The Ugly — Pavlin Marodiev[1], Claudio Tessone[1], Jan Lorenz[1,2], and •Frank Schweitzer[1] — [1]Chair of Systems Design, ETH Zurich, Kreuzplatz 5, 8032 Zurich, Switzerland — [2]Center for Social Science Methodolgy, University of Oldenburg, Ammerlander Heerstr. 114 - 118, 26129 Oldenburg, Germany

Wisdom of crowds (WoC) refers to the phenomenon that the aggregate prediction of a group of individuals can be surprisingly more accurate than individual estimates. However, as recent experiments with human subjects (PNAS, vol 108, no 22, 2011, pp. 9020-9025) revealed, already a mild social influence can undermine the WoC effect considerably. Specifically, if individuals are allowed to reconsider their estimates after having received either aggregated or full information of the estimates of others, they tend to converge to less accurate results while becoming overconfident of their false improvement. To better understand the conditions under which the WoC effect is likely to fail we provide a model where individuals are represented by Brownian agents which are coupled by information exchange. We demonstrate that the model can reproduce the empirical findings mentioned. We further discuss the impact of initial diversity and accuracy of estimates which directly determine whether social influence can improve or hamper the WoC effect.

SOE 10.2 Tue 14:15 H 0110

Consensus formation and the scientific process: When does consensus equal truth? — •Stefan Bornholdt — Institut für Theoretische Physik, Universität Bremen

Science partly is a social endeavor: Not only has a scientific truth to be found, but also be accepted by the scientific community. History of science is full of scientific discoveries that took considerable time to break a prevalent (untrue) consensus, often surpassing the lifetime of the discoverer, as for example the concept of continental drift by Alfred Wegener.

A first mathematical model studying the interplay of convergent opinion formation and exploratory truth seeking was proposed by Hegselmann and Krause [1]. We here study an alternative implementation, replacing the one-dimensional opinion space of that model by an infinitely large space of possible hypotheses, as proposed in a recent cellular automaton model for the emergence of paradigms [2]. Striving for new ideas is represented by a never-return rule that breaks detailed balance of exchange of ideas, while pressure towards consensus is implemented through social interaction rules. One observes that consensus-seeking counteracts truth discovery in the model. These models may provide insights for science funding and policy.

[1] R. Hegselmann and U. Krause, Truth and Cognitive Division of Labor: First Steps towards a Computer Aided Social Epistemology, Journal of Artificial Societies and Social Simulation 9 (2006).

[2] S. Bornholdt, M.H. Jensen, and K. Sneppen, Emergence and Decline of Scientific Paradigms, Phys. Rev. Lett. 106 (2011) 058701.

SOE 10.3 Tue 14:30 H 0110

Is there an optimum strategy for the penalty shoot-out in soccer? — •Metin Tolan — TU Dortmund, Fakultät Physik & DELTA, metin.tolan@tu-dortmund.de

The most exciting events of soccer tournaments are always penalty shoot-outs. Five players from each team have to shoot from 11 meters alternately on the goal. In this talk we will discuss some basic facts about the penalty shot and the penalty shoot-out. It will turn out that the penalty is a sort of an optimum compromise between a punishment of one team for some sort of unfair play and excitement since it is not sure that a penalty yields a goal. We will also discuss the optimum strategy for the team manager to figure out the order in which his players should do their penalty kicks. We will also see that the pressure on the first shooter is almost independent on the probability of the average success rate of his penalty shot.

SOE 10.4 Tue 14:45 H 0110

Towards the optimum prediction of soccer matches: concepts and limits — •Andreas Heuer and Oliver Rubner — Institut f. Phys. Chemie, WWU Münster, 48149 Münster

For an optimum prediction of soccer matches several key questions have to be answered. (1) What is the information content of different observables (previous results, chances for goals, home strength, market value of players, ...) about the quality of a team and how can this information content be defined? (2) How do these pieces of information transform into the explicit prediction of soccer matches? (3) How important are random, i.e. non-predictable, contributions? (4) How to define an optimum prediction on a solid statistical basis? Answers to these questions will be presented. It can be shown, that the predictions, based on the above-mentioned observables, are close but still slightly below the limit of optimum predictability. These concepts are applied to the Bundesliga season 2011/12 where the probabilities (and their statistical uncertainties) for all teams to reach a specific goal (Champions League, Europa League, avoiding relegation), based on the then available knowledge in March 2012, are calculated.

SOE 10.5 Tue 15:00 H 0110

Physics in penguin colonies — •Daniel P. Zitterbart[1,2], Sebastian Richter[1], Celine Le Bohec[3], Werner Schneider[1], Claus Metzner[1], Richard Gerum[1], Yvon Le Maho[3], Barbara Wienecke[4], and Ben Fabry[1] — [1]Biophysics Lab, Department of Physics, University of Erlangen, Germany — [2]Ocean Acoustics Lab, AWI, Bremerhaven — [3]IPHC, Centre National de la Recherche Scientifique, Strasbourg, France — [4]Australian Antarctic Division, Australia

In polar regions, highly adapted social behavior is crucial for the survival of several species. One prominent example is the huddling behavior of Emperor penguins. To understand how Emperor penguins solve the physical problem of movement in densely packed huddles, we observed an Emperor penguin colony (Atka Bay) with time-lapse imaging and tracked the positions of more than 1400 huddling penguins. The trajectories revealed that Emperor penguins move collectively in a highly coordinated manner to ensure mobility while at the same time keeping the huddle tightly packed. Every 30 - 60 seconds, all penguins make small steps, which travel as a wave through the entire huddle. Over time, these small movements lead to large-scale reorganization of the huddle. Our data show that the dynamics of penguin huddling is governed by intermittency and approach to kinetic arrest in striking analogy with inert non-equilibrium systems. We will also present observations from a different Emperor penguin colony (Adélie Land), an Adélie penguin colony (Adélie Land), and a King penguin colony (Crozet Island).

SOE 10.6 Tue 15:15 H 0110

Swarm model for the huddling behavior of Emperor penguins — •Richard Gerum, Claus Metzner, Daniel P. Zitterbart, and Ben Fabry — Biophysics Group, Friedrich-Alexander University, Erlangen, Germany

To withstand the Antarctic cold on open land for more than two months, Emperor penguins are forming densely packed huddles with a hexagonal lattice structure. Video recordings have revealed striking dynamical reorganization processes within those huddles (PLoS One, 6:e20260, 2011), including wave-like patterns, global rotatory motions and abrupt transitions to a disordered state. Here we show that basic aspects of the huddling behavior can be reproduced with simple systems of interacting point particles. For a more realistic modeling, the individual animals are treated as self-driven, information processing agents with situation-dependent behavior, similar to simulations of collective swarm behavior in flocks and herds. We present a multi-agent simulation in which both the spontaneous huddle formation and the observed wave patterns emerge from simple rules that only encompass the interaction between directly neighboring individuals. Our model shows that a collective wave can be triggered by a forward step of any individual within the dense huddle. The group velocity of the resulting wave is dependent only on the reaction times and the step velocity of the animals. By including the mutual adaption of individual body orientations, we present first results on rotary and curved movement patterns.