

## SOE 19: Social Systems, Opinion and Group Dynamics II

Time: Thursday 16:45–18:00

Location: ZEU 260

SOE 19.1 Thu 16:45 ZEU 260

**Evidence-based policy-making in sports funding using a data-driven optimization approach** — ●JAN HURT<sup>1</sup>, LIUHUAY-ING YANG<sup>1</sup>, JOHANNES SORGER<sup>1</sup>, THOMAS J. LAMPOLTSHAMMER<sup>2</sup>, NIKE PULDA<sup>5</sup>, URSULA ROSENPICHLER<sup>5</sup>, STEFAN THURNER<sup>3,1,4</sup>, and PETER KLIMEK<sup>3,1</sup> — <sup>1</sup>Complexity Science Hub, Vienna, Austria — <sup>2</sup>University for Continuing Education Krems, Krems, Austria — <sup>3</sup>Section for Science of Complex Systems, CeMSIIS, Medical University of Vienna, Vienna, Austria — <sup>4</sup>Santa Fe Institute, Santa Fe, NM, USA — <sup>5</sup>Austria

Many European countries face rising obesity rates among children. Access to sports facilities depends on multiple factors, such as geographic location, proximity to population centers, budgetary constraints, and other socio-economic covariates. Here we show how an optimal allocation of government funds towards sports facilitators (e.g. sports clubs) can be achieved in a data-driven simulation model that maximizes children's access to sports facilities. We find a characteristic sub-linear relationship between the number of active club members and the budget, which depends on the socio-economic conditions of the clubs' districts. In the model, we evaluate different funding strategies. We show that an optimization strategy outperforms a naive approach by up to 115% for 5 million Euros of additional funding to attract children to sports clubs. Our results suggest that the impact of public funding strategies can be substantially increased by tailoring them to regional socio-economic characteristics in an evidence-based and individualized way.

SOE 19.2 Thu 17:00 ZEU 260

**Fitting Polling Data with a Minimal Voter Model** — ●PHILIPP G. MEYER and RALF METZLER — Institute for Physics and Astronomy, University of Potsdam, Potsdam-Golm, Germany

The numerous versions of the voter model have various applications in opinion dynamics. We consider a two-state voter model for approval rates measured by political polls. We find that three features are essential for a realistic model.

Firstly, adding zealots (that never change their state) on both sides, prevents consensus. This behavior corresponds to the observations in the polling of parties. Such a voter model can be regarded as a stochastic process in a confining potential. Secondly, the measurement uncertainty of the polls has to be taken into account. It can be modeled by additive noise. Finally, we identify short-time autocorrelations between the steps, which lead to a higher variance than expected from the naive model.

We use techniques developed for voter models along with methods from stochastic processes for fitting data from political polls to the adapted voter model.

SOE 19.3 Thu 17:15 ZEU 260

**Reddit Revisited** — JOÃO PINHEIRO NETO and ●RICCARDO CARLUCCI — Max Planck Institute for Dynamics and Self-Organization, Am Faßberg 17, 37077 Göttingen

Social media research using Reddit as a data source has greatly increased in recent years. Researchers have used Reddit to study a wide variety of issues such as political polarization, depression, astroturfing, and market manipulation to name a few.

This is primarily made possible by the Pushshift project, which offers an almost-complete dataset of Reddit. Such a degree of completeness is unique among major social media platforms, and bypasses sampling issues that may otherwise make large-scale analysis challenging.

However, a considerable fraction of Reddit research uses data which is now already a few years old. At the same time Reddit has been steadily growing, both in terms of content and userbase. For example: half of all threads and comments ever created date back to the last 2 years, despite Reddit being more than 15 years old. In addition, the global COVID-19 pandemic is known to have affected users' social media consumption.

Here we present an updated overview of Reddit as seen through the Pushshift dataset, using data up to August 2022. First we discuss the evolution over time of various statistical observables from a large-scale perspective. Next, we study the life cycle of subreddits, users, and submissions. Finally, we study the response of individual subreddits to external events.

SOE 19.4 Thu 17:30 ZEU 260

**Topological insulators and enhancers in complex systems under generic problem-solving dynamics** — ●JOHANNES FALK<sup>1</sup>, EDWIN EICHLER<sup>2,3</sup>, KATJA WINDT<sup>3,1</sup>, and MARC-THORSTEN HÜTT<sup>1</sup> — <sup>1</sup>Constructor University, Bremen, Germany — <sup>2</sup>EICHLER Consulting AG, Weggis, Switzerland — <sup>3</sup>SMS Group GmbH, Düsseldorf, Germany

The collective coordination of distributed tasks in a complex system can be represented as decision dynamics on a graph. For the case of social differentiation tasks, experimental studies on human subject networks demonstrated that shortcuts in small-world networks can speed up the finding of global solutions. Using a computational model, we illustrate that this is not always true: Depending on the actors' reasoning and the length of the added links, shortcuts can serve as topological enhancers that speed up the finding of a solution, but also as topological insulators that make the network more difficult to solve. Our findings have implications for situations where in distributed decision systems regional solutions emerge which are globally incompatible such as e.g. known from the emergence of standards.

SOE 19.5 Thu 17:45 ZEU 260

**The emergence of echo-chambers in spatial collective estimation with limited connectivity** — ●MOHSEN RAOUFI<sup>1</sup>, HEIKO HAMANN<sup>2</sup>, and PAWEŁ ROMANCZUK<sup>1</sup> — <sup>1</sup>Department of Biology, Humboldt Universität zu Berlin, Berlin, Germany — <sup>2</sup>Department of Computer and Information Science, University of Konstanz, Konstanz, Germany

Using a method inspired by the wisdom-of-crowds effect [1] we study the speed-vs-accuracy tradeoffs (SAT) in a spatial collective estimation scenario. In this work, we highlight the link between the speed-vs-accuracy and exploration-vs-exploitation tradeoffs. Here we elaborate upon the role of network connectivity in the tradeoffs. On one hand, the network structure influences the dynamics of consensus-making in collectives. On the other, agents modify the network based on their opinion. We model this behaviour of agents based on homophily—the tendency of nodes to establish links with other like-minded nodes. This co-evolution of the network structure and opinion of agents shows rich dynamics, even for spatial networks. In particular, we demonstrate that in systems with limited connectivity, homophily can lead to the emergence of echo-chambers, which prevents consensus. Our focus for future work is to provide solutions within the capability of agents to bring global connectivity and thus the consensus back to the collective. [1] Raoufi, M., et. al. Speed-vs-Accuracy Tradeoff in Collective Estimation: An Adaptive Exploration-Exploitation Case. In 2021 International Symposium on Multi-Robot and Multi-Agent Systems (MRS) (pp. 47-55). IEEE.