

SOE 13: Focus Session: Opinion Formation

The dynamics of opinion formation is quite an interdisciplinary topic. It has gained increased attention in recent years since the emergence of filter bubbles and opinion polarization have been recognized as major societal problems. Further on, access to social media data has increased the options to study opinion formation data-driven. This focus session will present recent theoretical and empirical research on the dynamic of opinion formation for binary as well as for continuous opinions. (Session organized by Jan Lorenz)

Time: Thursday 9:30–11:30

Location: GÖR 226

SOE 13.1 Thu 9:30 GÖR 226

On Communicative Mechanisms Producing Filter Bubbles —

•JAN LORENZ¹, DANIEL GESCHKE², and PETER HOLTZ³ — ¹Jacobs University Bremen, Germany — ²Institut für Demokratie und Zivilgesellschaft, Jena, Germany — ³Leibniz-Institut für Wissensmedien IWM, Tübingen, Germany

The emergence of filter bubbles and echo chambers is a combined outcome of information filtering processes taking place on the individual, the social, and technological levels. Within this triple-filter-bubble framework, we construct an agent-based model and analyze different information filtering scenarios to answer the question under which circumstances social media and recommender algorithms contribute to fragmentation of modern society into distinct echo chambers. Simulations show that, even without any social or technological filters, echo chambers emerge as a consequence of cognitive mechanisms, such as confirmation bias, under conditions of central information propagation through channels reaching a large part of the population. When social and technological filtering mechanisms are added to the model, polarization of society into even more distinct and less interconnected echo chambers is observed. Directions for future research will be discussed, in particular, the link to social media data as well as a full characterization of systems dynamics.

SOE 13.2 Thu 9:45 GÖR 226

Do filter bubbles contribute to opinion polarization in online social networks? Insights from opinion-dynamics modeling. — •MICHAEL MÄS — University of Groningen, Groningen, The Netherlands

Political events such as the Brexit referendum, the election of Donald Trump, and the success of populists in democratic elections have sparked public and scholarly discussion about the effects of online-communication technology on public debate and collective decision-making. In particular, it has been warned that personalization algorithms installed in online social-networks, and search engines contribute to the formation of so-called ‘filter bubbles’. These bubbles isolate users from information that challenges their views and expose them to content that is in line with their opinions. It has been warned that this contributes to opinion polarization, a dynamic where competing political camps develop increasingly opposing political views. Here, I summarize research on the relationship between personalization and polarization. While I echo the warning that personalization can affect societal processes, I demonstrate that we leap to conclusions when we propose that personalization is responsible for increased polarization. Analyzing models of opinion dynamics in networks, I show that we lack crucial empirical insight into the microprocesses of social influence and the aggregation of repeated influence to macroprocesses of opinion polarization.

SOE 13.3 Thu 10:00 GÖR 226

User interactions on Twitter: Retweet versus reply networks —

•FELIX GAISBAUER, ARMIN POURNAKI, SVEN BANISCH, and ECKHARD OLBRICH — Max Planck Institute for Mathematics in the Sciences

User interaction on social media platforms, especially on Twitter, has been used extensively to monitor and analyse the spectra of political opinion and often serves as an empirical basis for modelling and investigating opinion dynamics. But previous studies on polarization and user interaction on Twitter have mainly focused on so-called retweet networks. There, separate clusters of users, which share content of each other, might be identified, and users of each cluster can then be assigned a certain political leaning on the topic under investigation.[1] We will show in this contribution that a retweet network alone often lacks crucial information about political discourse: It does not capture direct response patterns between users in general and specifically be-

tween users of different opinion groups. The communication (or lack thereof), apart from the simple information transfer by retweeting, is missed. Information about this type of interaction can be gathered with a reply network, constructed from the replies of users between each other. We analyse, among others, tweets about the Saxonian state elections of 2019 in order to substantiate this claim.

[1] Conover et al.: Political Polarization on Twitter. Fifth International AAAI Conference on Weblogs and Social Media (2011)

SOE 13.4 Thu 10:15 GÖR 226

Polarization in Opinion Landscapes —

•MARTIN GESTEFELD, NILS TOBIAS HENSCHER, JAN LORENZ, and KLAUS BOEHNEKE — Jacobs University Bremen, Germany

In recent years, politics and especially opinion formation in society appears to be more polarized than in the years before. Polarization can be proven in specific topics but there is still a lack of evidence for a general trend in society. First, in an exploratory data analysis, the evolution of individual responses has been analyzed on the left-right political self-placements and similar attitude in survey data. Trends in these aspects are captured and compared in the contexts of country and topic using representative survey data from 9 rounds of the European Social Survey. Applying a simple model demonstrates that people who placed their opinions on a 0 to 10 scale can be split up into 5 different groups. In addition to this model various formal measurements can be applied and provide information on the degree of polarization in distributions of attitudes. Concluding, this work extracts polarization and leads to an improved perspective on opinion formations through social surveys.

SOE 13.5 Thu 10:30 GÖR 226

Repulsion drives public opinion into fifty-fifty stalemate —

•SEBASTIAN M. KRAUSE¹, FRITZ WEYHAUSEN-BRINKMANN², and STEFAN BORNHOLDT² — ¹University of Duisburg-Essen, Lotharstr. 1, 47048 Duisburg — ²University of Bremen, Otto-Hahn-Allee, 28359 Bremen

The public opinion is often trapped in a fifty-fifty stalemate, especially in controversial debates. This jeopardizes broadly accepted political decisions. Here we demonstrate that fifty-fifty stalemates are favored in case of strong repulsion from opinions [1]. We study a voter model with two opinions and an undecided state in between. In pairwise discussions, undecided agents can be not only convinced, but also repelled from the opinion expressed by another agent, and decided agents may doubt and return to the undecided state. We find that the frequencies of both opinions equalize if an agent is repelled instead of being convinced in at least one out of four interactions, as in controversial debates. This voter model attractor reproduces the phenomenology of repeated Brexit poll data well.

[1] S.M. Krause, F. Weyhausen-Brinkmann, S. Bornholdt, Repulsion in controversial debate drives public opinion into fifty-fifty stalemate, PRE 100 (2019) 042307.

SOE 13.6 Thu 10:45 GÖR 226

Opinion Formation in distributed topologies: the voter model on hierarchical networks —

KATERYNA ISIROVA^{1,2}, OLEKSANDR POT², and •JENS CHRISTIAN CLAUSSEN¹ — ¹Department of Mathematics, Aston University, Birmingham B4 7ET, U.K. — ²V. N. Karazin Kharkiv National University, Ukraine

The voter model is a paradigmatic stochastic model that has been widely employed especially for modeling of emergent social phenomena as opinion formation. Consensus formation protocols however also occur in the dynamics of computer networks, where the verification of nodes may become time-critical in large networks, and depend on the network topology. In society, consensus is formed (or not) via messages to neighbours in the network and likewise depends on the

network structure. Here, we investigate the average time to consensus in a variety of different hierarchical and other network topologies, namely, small-world networks, various tree structures and hierarchical networks. For hierarchical networks, we consider the straightforward generalization where influencing a node occurs with different probability depending on the direction of hierarchy. Systematic Monte-Carlo simulations show that the average time to consensus in hierarchical networks is considerably larger than in regular graphs and small-world networks.

SOE 13.7 Thu 11:00 GÖR 226

Surprising Effects of Inhomogeneity on Opinion Dynamics

— •HENDRIK SCHAWÉ and LAURA HERNÁNDEZ — Laboratoire de Physique Théorique et Modélisation, Université de Cergy-Pontoise, France

We study the Hegselmann-Krause model for bounded confidence opinion dynamics. The premise is that an agent i will assume in each

timestep the average opinion of the agents whose opinions differ by at most ε_i from its own opinion x_i . In the original model, the confidence ε_i is equal for all agents, but since a society is usually comprised of diverse individuals, we study the case of inhomogeneous ε_i . This case is, up to now, mainly studied for few subpopulations each having a narrow range from which the confidences ε_i are drawn [1, 2]. Instead, we draw the confidences for each agent from parametrized uniform distributions $U(\varepsilon_l, \varepsilon_u)$. Our systematic study of the whole parameter space shows non-monotonous and counterintuitive behavior, e.g., increasing the trustfulness of the most open minded agents (i.e., increasing ε_u) may lead to a loss of consensus.

[1] Lorenz, J., Complexity, 15: 43-52 (2010), doi:10.1002/cplx.20295

[2] Liang, H., Yang, Y., Wang X., Physica A, 392(9): 2248-2256 (2013), doi: 10.1016/j.physa.2013.01.008

15 min. break