SOE 11: Polarization

Time: Wednesday 15:45–17:15   Location: GÖR/0226

SOE 11.1   Wed 15:45   GÖR/0226

Accurate mean-field predictions for cognitively grounded social influence dynamics with confirmation bias — •Sven Banisch — Karlsruhe Institute of Technology

Collective opinion formation in human groups is often modeled through cognitively rich agent-based dynamics, yet the resulting high-dimensional systems typically resist analytical treatment. Here we show that a class of cognitively grounded argument-exchange models with confirmation bias admits a low-dimensional and fully tractable mean-field representation. The key idea is to project pairwise agent rules onto an influence response function and then derive a two-compartment mean-field system whose Jacobian separates into a mean mode and a polarization mode. This yields a simple stability test that diagnoses the onset of symmetry breaking. We recover the consensus-to-polarization tipping point and identify a second threshold at which polarized equilibria become fully stable. Across all parameter regimes, the mean-field bifurcation structure accurately reproduces the behaviour of the full agent-based model. Our results provide a general mechanism-level framework for understanding how cognitive biases shape macroscopic opinion patterns, and demonstrate that high-dimensional social influence dynamics can exhibit simple and universal phase-space structure amenable to analytical classification.

SOE 11.2   Wed 16:00   GÖR/0226

Dynamics of ideologically polarized social media users — •Tristram Alexander and Jamie Tyler — University of Sydney, Australia

Social media users have been shown to exhibit different types of behaviour and preference on social media, depending on their ideological position on a left-right axis. This work investigates whether observed differences may be attributed to intrinsic differences in the users, or whether the differences emerge based on interactions in the social media environment.

The study is based on interactions between users on the Twitter/X platform. Users are classified on a left-right scale based on their retweet activity, and placed into categories based on their position on this scale. The reply activity between users is then examined to determine the rates of interaction between the different classes of user. The population of the users in each interaction class is then estimated, based on frequencies of interaction between the classes.

The study finds that users appear to have the same intrinsic behaviour, irrespective of ideological class, but that they behave differently due to the population imbalance between the classes on the platform. This leads right-leaning users to be more active then left-leaning users, which is posited as a reason for greater observed departure rates of right-leaning users from the platform. A model of this interaction behaviour is developed and mapped to the observations. The results of this work may inform the further development of opinion dynamics models.

15 min. break

SOE 11.3   Wed 16:30   GÖR/0226

Campaign-spending driven polarization transition in a double-random field model of elections — •Jan Korbel[1], Remah Dahdoul[1], and Stefan Thurner[1,2,3] — [1]Complexity Science Hub, Vienna, Austria — [2]Medical University of Vienna, Austria — [3]Santa Fe Institute, NM, US

We model bipartisan elections where voters are exposed to two forces: local homophilic interactions and external influence from two political campaigns. The model is mathematically equivalent to the random field Ising model with a bimodal field. When both parties exceed a critical campaign spending, the system undergoes a phase transition to a highly polarized state where homophilic influence becomes negligible, and election outcomes mirror the proportion of voters aligned with each campaign, independent of total spending. The model predicts a hysteresis region, where the election results are not determined by campaign spending but by incumbency. Calibrating the model with historical data from US House elections between 1980 and 2020, we find the critical campaign spending to be ~1.8 million USD. Campaigns exceeding critical expenditures increased in 2018 and 2020, suggesting a boost in political polarization.

SOE 11.4   Wed 16:45   GÖR/0226

Information Saturation in the Political Center Drives the Spread of Extreme Content — •Markus Hofer[1,2], Jan Korbel[2], and Stefan Thurner[1,2,3] — [1]Center for Medical Data Science, Institute of the Science of Complex Systems, Medical University of Vienna, Vienna 1090, Austria — [2]Complexity Science Hub Vienna, Vienna 1030, Austria — [3]Santa Fe Institute, Santa Fe, NM 87501

Although most voters hold moderate opinions, online discourse is increasingly dominated by ideological extremes. To understand this phenomenon, we employ an agent-based model in which post-sharing mediates all opinion dynamics. First, agents filter posts based on ideological distance to update their own opinions. Then they select one of the received posts based on novelty, quantified as the local information-theoretic surprisal. Here we show that empirically consistent opinion distributions with moderate polarization naturally emerge alongside a disproportionate sharing of extreme content. We identify the underlying mechanism as a density-dependent competition for novelty: high post density in the political center leads to information saturation, effectively suppressing surprisal and resharing. In contrast, extreme content maintains high surprisal, increasing its resharing probability. This mechanism explains the heavy-tailed cascade distributions observed on Twitter/X and points toward interventions that reduce the informational novelty advantage of extreme content.

SOE 11.5   Wed 17:00   GÖR/0226

The role of antagonization in political discourse on social media — •Armin Pournaki and Eckehard Olbrich — Max Planck Institute for Mathematics in the Sciences, Leipzig, Germany

Antagonization is a central discursive strategy in political narratives. The creation of an enemy allows for political mobilization through powerful affective mechanisms. It is commonly assumed that social media, through a combination of platform affordances and algorithmic amplification, reward and therefore enhance antagonizing content. However, it is an open empirical question whether the prevalence and nature of antagonization as a discursive strategy depends on the political leaning, or whether different political camps antagonize equally. The present work aims to address those questions by presenting a novel computational approach to systematically extract traces of antagonization from text, including potential targets of antagonization. On a corpus of 1M tweets from the German Twittersphere, we observe a strong prevalence of antagonizing content, confirming common hypotheses by which social media tend to facilitate such discourse. By combining the method with a large-scale estimation of ideological positions of users based on their retweet behaviour, we show that antagonization is significantly more prevalent in the online discourse of right-leaning than of left-leaning actors. Finally, a systematic analysis of the various antagonized targets provides novel insights into how different political factions employ this strategy to mobilize their audience.