The effect of new issues in a polarized society: ABM approach

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Short Title: New issues ABM

Motivation & expertise

Motivation:

We, František and Ashwin, want to start a branch of an ongoing project with new collaborators who have similar interests. So far we have been working for over a year on an agent-based modeling project aimed at studying the dynamics of polarization with two other colleagues (Michael D. Slater, Ashley Sanders-Jackson).

We have successfully concluded the first phase with a manuscript submitted to proceedings from Social Simulation Conference, Milano 2022. We see multiple paths further from this stage. Our colleagues are communication scholars interested in the study of media agents and simulations of communication theories (all four of us are especially dedicated to building towards the Reinforcing Spirals Model (Slater 2007)).

But there are still many research questions relating to polarization in our model the two of us wish to explore that are not primarily of interest to our other colleagues. One such question (the subject of this proposal) was inspired by repeated questions from audiences at conferences: Do new issues serve more as bridges overcoming polarization or more as fences deepening it? What is the effect of the previously polarized public sphere on newly entering issues? This inspires us to look at mutual relationships of previously polarized issues and new issues in one common public sphere.

While we, František and Ashwin, are very interested in this general question, pursuing it would require us branching into a new direction so that our collaboration with the communication scholars (Michael and Ashley) proceeds as intended. Therefore we wish to open up this research question for exploration to participants of BIGSSS Summer School on CSS of Democratic Debate. We are hoping to meet exciting new colleagues with fresh perspectives and skills for their inputs on this question. We also hope to be able to take a successful collaboration further and publish the results of our explorations.

Expertise:

František is an experienced public opinion researcher who loves agent-based modeling. František has 20 years of public opinion survey analyses, including panel data. In his (for this summer school relevant) research he focuses on theories of public opinion formation and their empirical testing: mainly Agenda-setting (e.g. Váně, Kalvas 2013), Framing (e.g.

Kalvas et al. 2012) and laboratory experiments on Spiral of silence (Kalvas, Přibylová 2017). Besides classical methods for acquisition and analysis of data on the public opinion (survey, panel, laboratory experiments), František loves to use agent-based modeling (ABM). In various personal and collaborative projects František has been coding ABMs in NetLogo since 2010. František is experienced in R, Stata and SPSS regarding data analysis and presentation of its results. He uses standard methods, e.g. multivariate regression (including versions appropriate for panel data), but also Monte Carlo simulations. In network analysis, so popular today, he is just a versed beginner. For details, please see the CV.

Ashwin is an early career researcher with experience in cognitive science research and agent-based modeling. His skills include agent-based model development in Netlogo and Python, statistical analyses, machine learning, Javascript programming, and psychophysical experiments. He also is a passionate teacher and tutor with experience as a Teaching Assistant in summer-schools, and as a teaching fellow and lead instructor in undergraduate coursework.

Project Proposal

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Research Questions:

1. How does a polarized society react to the sudden introduction of a new issue into the democratic debate?
2. Are there some societies where new issues tend to promote consensus rather than polarization, or vice versa?
3. What features of society determine whether the new issue promotes consensus or further polarization?
4. How does the present state of the public sphere influence polarization of the new issue that just entered the public debate?
5. How do new issues influence the state of the public sphere – do they serve as bridges and diminish polarization or do they serve as fences and promote further polarization?

Data

We plan to answer research questions by analyzing results of simulation experiments. But (at least part of) these experiments we plan to calibrate by various survey data including longitudinal (e.g. European Social Survey, German Longitudinal Election Study, Swiss Household Panel, Naše společnost (Our Society) etc.).

Methods:

Keywords: Agent-Based Modelling, Statistics, Survey-based model calibration.

We hope to study a public opinion process where new issue(s) enter(s) a previously polarized public sphere through survey-based calibrated agent-based models. We offer a version of the Hegselmann-Krause model advanced by dynamic identity groups (Kalvas, Ramaswamy, Sanders-Jackson & Slater 2023). This model captures a mult- dimensional public sphere and allows agents to dynamically recognize identity groups. For this project, we plan to update the model with a component creating polarized starting conditions in selected dimension(s). (In case the group is disinterested in coding this component we already have a prototype of the model with this component including preliminary simulations and analyses here: https://github.com/frantisek901/Spirals/tree/master/PolarizedStart)

We also plan to use empirical data to calibrate the initial conditions in our model, i.e. to initialize polarized dimension(s) according to real polarized opinions and initialize fresh dimension(s) according to opinion distribution of real new issues. We will study: (a) theoretical parameter space systematically – it allows us to investigate possible effects of combinations of different polarized starting conditions and identity group parameters; (b) various polarized starting conditions calibrated according survey data combined with fresh issues initialized according various theoretical distributions, and (c) various combinations of survey-based calibrated polarized public spheres and survey-based calibrated fresh issue(s).

Project Description

Models of public opinion dynamics usually start simulation of the opinion process with random distribution of opinions. In reality though, societies exist in a variety of states with respect to polarization. Moreover real public opinion has more dimensions and its issues have different degrees of maturity – some issues might be fresh, while discussion on others might have stabilized. The sudden introduction of new issues in a society can cause interesting effects on public opinion. For example, the emergence of the COVID-19 pandemic led to public opinion over the issue being divided along pre-existing fault lines in the US, despite the issue itself being ideologically neutral (Sharkey 2020). While it is possible that the new issue interacts differently with the interests of different factions in a polarized society - thus making it not a truly neutral issue - it is also possible that the sudden introduction of a new opinion dimension is sufficient to exacerbate polarization under some circumstances. Therefore in this project we hope to explore the computational consequences of suddenly raising the dimensionality of a polarized society.

Practically, the group will design and run experiments with the theoretical model, then we will calibrate the theoretical model by survey data, then we will design and run experiments with the calibrated model, and finally we will analyze all the results. Firstly, we will start with a finalizing module for polarized initial conditions. Secondly, we will together design a simulation experiment with the finalized model and we will run it in the cloud. Thirdly, we will update the model by component allowing model calibration. At this point we will discuss and plan the structure of calibrated data. Fourthly, while coding the calibration component, we will analyze survey data and produce calibration data from them. Fively, we will design and run in the cloud experiments with the calibrated model. Sixthly, we will analyze produced data. We will start with experiments with the theoretical model, since they will stop first. Then we move to the calibrated model. Finally we might compare survey data with the state space

of the theoretical model and determine in which regions operate societies that produced these survey data.

Project leaders bring to the summer school a functional piece of software able to perform simulation experiments immediately, but they are open to ideas of all group members and they love to give them their voice. We might change the architecture of the module, we might change the core model it is implemented for (Hegselmann, Krause 2002), but then we have to sacrifice some parts of the plan depicted above. Project leaders are prepared for such a sacrifice – we prefer all group members well incorporated to the group work more than fulfilling initial ambitious plans. So we are open to different basic models, different implementations of identity, different sources of data for calibration. We are also open to comparisons of models, identity implementations and data sources. Our plan is just a consistent kick-off which is open to modification after the first group discussion at the summer school – do not hesitate to tell us your ideas, needs and dreams, we will find together productive ways how to incorporate them into group work!

Lecture and hands-on workshop proposals

We are offering both. One option is lecture on theories of public opinion formation and outlook on their potential for modeling with a warning of potential pitfalls. The second option is a hands-on workshop on implementation of our dynamical identity groups recognition in three computer languages (NetLogo, Python, JavaScript).

Lecture (František): On public opinion theories

The lecture firstly reviews theories of the public opinion formation from psychology, sociology and political science, secondly it supports these theories by empirical research (including author's papers) and thirdly it shows in which models we might find these theories implemented and which theories still await for their implementation. Psychological theories are mainly useful as inspiration for individual updating of agents' opinions. They are in principle based on architecture 'stimulus - organism - reaction', so these theories tell us how individuals update opinions (reaction) according to their internal values and parameters (organism) and presence of various opinions in their environment (stimulus). This layer is also recognized by sociological and political science theories, but they also add social and structural relationships (sociology) or power (political science). It is interesting that all three disciplines take into account media as important agents in the process, but differently: for psychology and sociology media are information sources, for sociology also special institutions, and political science conceptualize them as source of power. That's why we will briefly go through theories of media content formation – it gives modelers freedom to produce content of information sources in their models just simply or according to more sophisticated models which might be even influenced by the public opinion and its dynamic.

Since František spent the majority of his career researching Agenda-setting, Framing and Spiral of silence theories, these will be exclusively supported by his own research. Center of gravity is in these three studies (Kalvas et al. 2012, Váně, Kalvas 2013, Kalvas, Přibylová

2017). Unfortunately, two of them are in Czech, so they are not useful as pre-read, but everything will be presented well in English during the lecture.

From reviewed theories the psychological theories of opinion updating are represented the most entirely. See e.g. Flache et al (2017), each main model reviewed there has theoretical justification or describes some psychological theory of opinion updating. Some models there mention sociological justification, e.g. group pressure, conformity to norms. Less attention from the modeling community is received by interesting and more complex theories such as Agenda-setting, Spiral of silence and Framing. We might find decent tries to model at least part of these theories or use some of their concepts. The lecture concludes with a brief description of structure or schema of these theories accenting heterogeneity of theorized actors/agents and possibilities on how to capture these theories by agent-based models.

Hands-On Tutorial (Ashwin): Agent-Based Modelling of dynamical identity groups recognition: Python, NetLogo, JavaScript

We propose to hold a hands-on tutorial with two broad learning aims:

(a) to enable familiarity with our implementation of Social Identity and its parametrization within a Hegselmann-Krause framework in opinion dynamics (Kalvas, Ramaswamy, Sanders-Jackson, & Slater 2023).

(b) to aid hands-on learning of agent-based modeling across three modeling environments - NetLogo, Mesa (Python), AgentScript (JavaScript).

While NetLogo is widely used in ABM research and pedagogy, newer Agent-Based Modelling environments have been written as libraries for popular programming languages like Python and JavaScript, making the practice of Agent-Based Modeling more accessible to these programmers and communities more comfortable with these languages. These languages have their own advantages - Python has several libraries that make data analysis straightforward, while JavaScript can be leveraged to make browser-friendly simulations embedded in web pages that would be especially useful for communication to an audience unfamiliar with NetLogo.

In this hands-on tutorial we will be implementing a component of our identity groups model in each language. By the end of the session participants will develop a deeper understanding of identity groups modeling, and be set to get started with Agent-Based Modeling in any of the three languages.

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