BAMBERG GRADUATE SCHOOL OF SOCIAL SCIENCES

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FURTHER EDUCATION | WORKSHOP

Basics of Agent-Based Modeling

Instructor: Assistant Professor Dr Daniel Mayerhoffer, University of Amsterdam

Date & Time: Monday, 19 May 2025, 09.00 a.m. to 05.00 p.m. (s.t.)

Friday, 23 May 2025, 09.00 a.m. to 01.00 p.m. (s.t.)

Place: BAGSS, Feldkirchenstraße 21, 96050 Bamberg, Room FG1/00.06

Registration: To register, please send an email to courses.bagss@uni-bamberg.de by 28 April 2025. Registration is mandatory. The number of participants is limited to 14.

Short Outline

Agent-based models [ABMs] are becoming increasingly attractive in the social sciences. ABMs are used to simulate the emergence of complex macro phenomena based on individual actions. Such simulation can be integrated in the pipeline of data-driven research in various ways.
Before data collection or analysis, ABMs can help operationalise theory and explore candidate explanations in preparation of subsequent empirical work; furthermore, simulation can identify key actors to investigate with quantitative as well as qualitative designs. After data analysis, simulation can help fill gaps or detail the causal inferences identified. On some occasions, simulation may be the only way to retrieve data (in an ethically acceptable way) at all.
Because the researchers have full control over their ABM, they can monitor all cognitive processes of their agents and social they deem interesting in arbitrary granularity, while at the same time running virtually unlimited repetitions and parameter settings. Consequently, data from ABMs combines advantages of quantitative (large N) and qualitative (rich, detailed) data. However, simulation output is only meaningful if the simulated social system resembles the real world in the relevant respects. Thus, appropriate calibration and validation is key to successful research using ABMs.

The aim of this course is to provide epistemic and methodological background on Agent-Based Modelling and guide through the conceptual development of ABMs as well as their implementation using the free software NetLogo [http://ccl.northwestern.edu/netlogo/]. Its programming language is intuitively accessible even without previous programming or computer science knowledge. Therefore, the tool is ideally suited for social scientists who aspire to use simulated data from ABMs to pilot or complement empirical data.

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As a complement to NetLogo, we will discuss the implementation of ABMs in other programming languages such as Python, Julia, R or C++. Moreover, we will experiment with using Large Language Models to conceptualise and implement ABMs. With that you can integrate ABMs into their individual research pipelines.

After completion of this course, you will be able to...

- Conceptualise common types of ABMs and implement them in NetLogo.
- Understand and apply all major NetLogo commands.
- Know the fundamentals of implementing ABMs independent of programming language.
- Use Large Language Models as “collaborators” for defining and refining ABM concepts and implement these concepts in the programming language of your choice.
- Critically evaluate your and others’ ABMs in terms of internal and external validity.
- Identify potential use-cases of ABMs in your research settings.

About the Trainer

Daniel Mayerhoffer is a BAGSS alumnus (Pillar 4, class of 2022) and now Assistant Professor at the University of Amsterdam. There, he teaches in the Bachelor Program Computational Social Science, is a member of the Institutions, Inequalities, and Life courses research group in Sociology, and an affiliate of the Data Science Centre.
Daniel uses Agent Based Simulation, among and in combination with other methods, to explain and predict complex socio-technical systems to enhance their governance. He applies Computational Models mainly to questions in Economic Sociology, Collective Behaviour and Political Epistemology. Namely, he studies the perception of (economic) inequalities in homophilic networks, and the resulting individual and collective actions. Furthermore, Daniel evaluates these models from an analytical and Philosophy of Science perspective.

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