Stockholm University

2014-02-11,
rev. 2014-04-24

Department of Sociology

Models of Social Change and Social Stability

7.5 ECTS credits

Instructor

Viktoria Spaiser

Researcher at the Institute for Futures Studies (IFFS), Stockholm

Affiliated researcher at Stockholm University

viktoria.spaiser@iffs.se

Course content

The course provides an introduction to formal modelling techniques, with a focus on applications in social sciences. The course has three main focuses and goals: 1) students should learn what modelling and what formal modelling is; 2) students should learn what formal models exist in social science already and how these models can be used in research; 3) students should reflect which social science theories (for instance those they are using in their own PhD research) could and should be formalised and they should learn how to do this by applying formalisation techniques to a theoretical problem. Formal models are used in social sciences as abstract representations of complex social mechanisms in stylized form. Good modelling requires fluency in social science theory, as well as the substantive knowledge to design appropriate and insightful models for specific phenomena. Mathematics is often used as the most advanced formal language to express formal relations. However, it is also possible to use formal logic expressions and to design algorithmic formal models (e.g. Agent-Based Models). Finally, graph theory (a branch of mathematics) is used to design graphical formal models like social network models for instance. Formal models are furthermore often a combination of these three formalisation approaches. The benefits of a formal approach include increased clarity and precision and therefore a better understanding in terms of theory and empirical testing. The course will provide students with the necessary knowledge to understand formal models in the literature and will give an introduction to the usage of formal modelling techniques in their own research.

Stockholm University

Learning outcomes

After accomplishing this course, participants are expected to:

In terms of knowledge and understanding:

- Have knowledge about modelling and formal modelling and understand the difference
- Have knowledge about common formal models used in social sciences and understand them

In terms of accomplishment and competence:

- Be able to make use of common formal models from literature for research purposes
- Be able to identify social theory that can be formalized
- Be able to identify the formalization approach most appropriate in theoretical terms and for research purposes
- Be able to formalize a chosen social theory (or part of it)

In terms of values and evaluation:

- Be able to critically assess common formal models in social sciences in terms of their merits and limitations
- Be able to critically access different formalisation techniques and their usability in different contexts and for different research purposes

Teaching

The teaching is provided in the form of five lectures (each two hours with a short break) and two compulsory exercise sessions (each two hours with a short break). Students are expected to complete assigned reading before each class meeting and participate actively in class discussions and exercises.

Examination

The course assessment is in the form of an oral exam where the student is expected to discuss formal modelling in conceptual terms and in terms of common formal models in the social science and to present his/her own application of formal model techniques to a chosen theoretical problem. Each student is expected to hand in a one-page proposal of a social theory (or part of it) that he/she wants to formalize before the first compulsory exercise session.

Stockholm University

The assessment uses the following criterion-referenced grades: A=Excellent, B=Very good, C=Good, D=Satisfactory, E=Sufficient, Fx=Not sufficient, F=Fail. The following four dimensions are considered for the oral exam:

1. Understanding modelling and formal modelling conceptually.
2. Understanding common formal models in social sciences.
3. Applying formal modelling techniques to a chosen social theory.
4. Critically discussing common formal models and formal modelling techniques and their applicability.

A summarising assessment of the oral exam for each dimension is made by the examiner using three steps

1. Good
2. Passed (some insufficiencies)
3. Failed

based on following criteria:

- For the grade A, no insufficiencies (level Passed) of any dimension are allowed.
- For the grade B, insufficiencies (level Passed) for one dimension are allowed.
- For the grade C, insufficiencies (level Passed) for two dimensions are allowed.
- For the grade D, insufficiencies (level Passed) for three dimensions are allowed.
- For the grade E, insufficiencies (level Passed) for all dimensions are allowed.
- Failing one dimension leads to the grade Fx.
- Failing more than one dimension leads to the grade F.

Students with the grade Fx or F are entitled to repeat the oral exam in order to achieve at least grade E. A student with the grade E or higher is not entitled to another examination to raise his/her grade. Students who received grade Fx or F on exams twice from the same examiner can request to be evaluated by another examiner. Such requests should be sent to the Director of Studies. Students can request to have examination according to this syllabus up to three semesters after the syllabus is no longer valid. Such requests should be sent to the Director of Studies.

Schedule

1. May 6: 10-12 a.m. F339
   Introduction: Modeling and Formal Modeling. Mathematical Modeling, Logic/Algorithmic Modeling, Graphical Modeling, Mixed Formal Models
   Please Read:
   - Miller, J.H. & Page, S.E. (2007): *Complex Adaptive Systems. An Introduction to Computational Models of Social Life*. Princeton University Press. Chapter 3.

Stockholm University

- Epstein, J. M. (2008): "Why Model?" In: *Journal of Artificial Societies and Social Simulation*. 11(4): http://jasss.soc.surrey.ac.uk/11/4/12.html
- Klüver, J.; Stoica, C. and J. Schmidt (2003): "Formal Models, Social Theory and Computer Simulation: Some Methodological Reflection." In: *Journal of Artificial Societies and Social Simulation* 6(2): http://jasss.soc.surrey.ac.uk/6/2/8.html

2. May 13: 10-12 a.m. FB610
   Mathematical Modeling and Mathematical Models in Social Sciences
   Deadline: one-page proposal of a social theory (or part of it) that the student wants to formalize
   Please Read:
   - Sorensen, A. B. (1978): Mathematical Models in Sociology. In: *Annual Review of Sociology*, Vol. 4., pp. 345-371
   - Dodds, P. S. and Watts, D.J. (2004): Universal Behavior in a Generalized Model of Contagion. In: *Physical Review Letters*, 92 (11), 218701
   - Gilboa, I. and Matsui, A. (1991): Social Stability and Equilibrium. In: *Econometrica*, 59 (3), 859-867.
   - Granovetter, M. (1978): Threshold Models of Collective Behavior. In: *The American Journal of Sociology*, 83 (6), 1420-1443.
   - Brown, C. (2007): Differential Equations: A Modeling Approach (Quantitative Applications in the Social Sciences). SAGE. Chapter 1.

3. May 15: 10-12 a.m. B397
   Exercise Session in Mathematical Modeling

4. May 20: 10-12 a.m. F255
   Algorithmic Modeling and Computational Models in Social Sciences:
   Please Read:
   - Macy, M. W., and Willer, R. (2002): "From Factors to Actors: Computational Sociology and Agent-Based Modeling." *Annual Review of Sociology* 28:143-166.
   - Railsback S. F. and Grimm V. (2011): *Agent-Based and Individual-Based Modeling: A Practical Introduction*. Princeton University Press. Chapter 1.4 and Chapter 3
   - Epstein, J.M. (2006): *Generative Social Science*. Princeton University Press. Chapter 1, 9 and 10.
   - Schelling, T.C. (1971): Dynamic Models of Segregation. In: *Journal of Mathematical Sociology*, 1, 143-186.

5. May 27: 10-12 a.m. B497
   Graphical Modeling and Social Network Analysis in Social Sciences:
   Please Read:
   - Pescosolido, B. A. (2007): The Sociology of Social Networks. In: Bryant, C. D. and Peck, D. L. (eds.): 21st Century Sociology. SAGE: http://www.uk.sagepub.com/leonguerrero4e/study/materials/reference/05434_socnet.pdf

Stockholm University

- Ruohonen, K. (2013): *Graph Theory Tutorial*. Tampere University of Technology. URL: http://math.tut.fi/~ruohonen/GT_English.pdf
- McPherson, M; Smith-Lovin, L. and Cook J.M. (2001): Birds of a feather: Homophily in social networks. In: *Annual Review of Sociology*. 27, 415-444.
- Coles, N. (2001): It's not What You Know – It's Who You Know That Counts. Analysing Serious Crime Groups as Social Networks. In: *British Journal of Criminology*, 41(4), 580-594.
- Vitali, S.; Glattfelder, J.B. and Battiston, S. (2011): The Network of Global Corporate Control. In: *PLoS ONE*, 6 (10): e25995. doi:10.1371/journal.pone.0025995

6. May 28: 10-12 a.m. B397
   Exercise Session in Algorithmic and Graphical Modeling

7. June 3: 10-12 a.m. D255
   Mixed Formal Models in Social Science: Mathematical Agent Based Models, Graphical Probability Models, Social Network Based ABM
   Please Read:
   - Bhavnani, R.; Donnay, K.; Miodownik, D.; Mor M. and Helbing, D. (2013): Group Segregation and Urban Violence. In: American Journal of Political Science, 58 (1), 226-245.
   - Epstein, J.M. (2006): *Generative Social Science*. Princeton University Press. Chapter 7.
   - Spirtes, P. (2005): Graphical models, causal inference and econometric models. In: *Journal of Economic Methodology*, 12(1), 1-33.
   - Singer, H.M.; Singer, I. and Herrmann, H.J. (2009): Agent-based model for friendship in social networks. In: *Physical Review*, 80, 026113.

8. June 5: 10-14 p.m. B419
   Oral Exam

Required reading (books)

Epstein J.M. (2006): *Generative Social Science*. Princeton University Press

Miller, J. H. & Page, S. E. (2007): *Complex Adaptive Systems: An Introduction to Computational Models of Social Life*. Princeton University Press

Railsback S. F. and Grimm V. (2011): *Agent-Based and Individual-Based Modeling: A Practical Introduction*. Princeton University Press.