Modeling epistemic and scientific groups: interdisciplinary perspectives
November 25-26, 2013

Program

Monday 25
9h15-9h30: welcome
9h30-10h25: Jason McKenzie Alexander (LSE, UK): "Epistemic Landscapes and Optimal Search"
10h25-11h20 Rainer Hegselmann (University of Bayreuth, Germany): "Understanding epistemic grouping, networking and division of labour. What can simple macroscopic models do?"
11h20-11h40: coffee break
11h40-12h35 Igor Douven (University of Groningen, The Netherlands): "Inference to the Best Explanation versus Bayes' rule in a social setting"
12h35-14h00: lunch
14h00-14h55: Francis Bloch (Ecole Polytechnique, France): "Coalitions and networks in economics"
14h55-15h50: Thomas Boyer-Kassem (University Lille 3, STL and AHP, France) & Cyrille Imbert (CNRS, Archives Henri Poincaré, France): "Modeling scientific collaboration from the micro"
15h50-16h10: coffee break
16H10: 17h05. Krist Vaesen (Eindhoven University of Technology, The Netherlands): "Cultural evolutionary theory and the collective dimensions of science"

Tuesday 26
9h00-9h55: David Chavalarias (CAMS/ISC-PIF, CNRS – EHESS, France): "Science Phylomemies: automatic sketches of science evolution"
9h55-10h40: Andrea Scharnhorst (DANS, Royal Netherlands Academy of Arts and Sciences (KNAW), The Hague, The Netherlands): "Maps and instruments for the navigation on the ocean of scientific knowledge"
10h40-11h10:
11h10-12h05 Cédric Patternotte (LMU, Munich Center for Mathematical Philosophy, Germany): "Scientific virtues as catalysts"
12h05-14h00
14h00-14h55 Carlo Proietti (Lund University, Sweden): "Herd behavior and reasoning about other minds"
14H55-15H15
15h15-16h10: Hans van Ditmarsch (CNRS, LORIA, France): Lying in dynamic epistemic logic

Abstracts

Prof. J. McKenzie Alexander (LSE, Dept. of Philosophy), J. Himmelreich (LSE, Dept. of Philosophy) and Dr C. J. Thompson (University of Cambridge)
"Epistemic Landscapes and Optimal Search"
In 2009, Michael Weisberg and Ryan Muldoon published a paper in which they argued that the division of cognitive labour could be explained on epistemic grounds. In particular, they argued that so-called "maverick" scientists had greater epistemic success than other kinds of researchers, and that the best overall epistemic success — at the aggregate level of the population — was given by a polymorphic, cognitively diverse population of scientists. In this talk, I shall show that these two claims were generated by simulation results containing implementation errors and, when these errors are corrected, the results no longer obtain. I then consider a generalization of the Weisberg-

Muldoon model to NK-fitness landscapes, and show that social learning does not often yield epistemic improvement on rugged epistemic landscapes.

Francis Bloch (Ecole Polytechnique, France)
"Coalitions and networks in economics"

Economists model the formation of coalitions and networks as rational choices made by selfish agents. In order to understand the architecture of social networks or the distribution of agents across groups, we specify the value that agents obtain from the network and group, and the process by which coalitions and networks are formed. We study the formation of groups and networks as a game, and compute the equilibrium outcome of different processes – some of which are simultaneous processes where agents make their decisions at the same time and others sequential procedures where agents make decisions after observing each other's behavior. We illustrate the differences between the processes through the analysis of collaborative alliances among firms.

Thomas Boyer-Kassem (University Lille 3, STL and AHP, France) and Cyrille Imbert (CNRS, Archives Henri Poincaré, France)
"Modeling scientific collaboration from the micro"

This paper is concerned with collaboration between researchers in the academic world and especially in science. We aim at evaluating collaboration from the viewpoint of knowledge production. For this, we propose a formal model, which accounts for collaboration with minimal hypotheses. *n* researchers are working on a sequential problem, and collaboration amounts to sharing the intermediate results. When simulated, our model provides balanced results: if collaboration is always preferable for 2 researchers, it is not so for *n* researchers, from their individualistic viewpoint. We also analyze the dynamics of the formation of coalitions, and we study the optimal group size. We finally aggregate results and study how researchers should behave in various environments (e.g. low/high concentration in the community; efficiency of groups within community of various sizes, etc.) More generally, our model enables to account for collaboration from the micro scale, and to derive the efficiency profiles instead of arbitrarily assuming them.

David Chavalarias (CAMS/ISC-PIF, CNRS – EHESS, France)
"Science Phylomemies: automatic sketches of science evolution"

How is science evolving? Is it possible to map the landscapes of science and their transformations? Can we automatically decipher the history of a research field, monitor emerging fields, and detect research hybridization events? The recent Information and Communication TechnologyCT (ICT) revolution has, at an ever-growing pace, opened up new digital spaces, offering new opportunities to track the dynamics of knowledge, through the examination of its digital trails.
In this presentation, we will introduce an automated method that can be used to reconstruct the cognitive evolution of science from large-scale analysis of publications datasets. This evolution is modeled as lineage relationships between scientific fields, a structure named *phylomemy*, by analogy with biological evolution. Phylomemies are based on the analysis of the textual content of publications. They describe how the scientific fields evolve and provide a convenient model to investigate science evolution.
References
[1] Chavalarias, David, and Jean-Philippe Cointet. 2013. "Phylomemetic Patterns in Science Evolution: The Rise and Fall of Scientific Fields." PLoS ONE 8:2.
[2] Callon, Michel, Jean-Pierre Courtial, and Francoise Laville. 1991. "Co-word Analysis as a Tool for Describing the Network of Interaction between Basic and Technological Research: The Case of

Polymer Chemistry." Scientometrics 22:155–205.

Hans van Ditmarsch (CNRS, LORIA, France)
"Lying in dynamic epistemic logic"

We propose a dynamic logic of lying, wherein a 'lie that phi' (where phi is a formula in the logic) is an action in the sense of dynamic modal logic, that is interpreted as a Kripke model transformer relative to the formula phi. Such Kripke models encode the uncertainty of agents about their beliefs. Lies can be about factual propositions but also about modal formulas, such as the beliefs of other agents or the belief consequences of the lies of other agents. We distinguish an outside observer who is lying to an agent that is modelled in the system, from an agent who is lying to another agent, and where both are modelled in the system.

reference: Hans van Ditmarsch, Dynamics of Lying, Synthese
http://link.springer.com/article/10.1007%2Fs11229-013-0275-3

Igor Douven (University of Groningen, The Netherlands)
"Inference to the Best Explanation versus Bayes' rule in a social setting"

According to the Inference to the Best Explanation (IBE), explanatory considerations have confirmation-theoretic import. This rule faces two well-known Bayesian challenges, one from dynamic Dutch book arguments, and one from inaccuracy minimization arguments. In recent work, I argued that IBE can meet both challenges: even if following IBE were to make one vulnerable to Dutch books (which it need not do), the rule has compensating advantages; and given various plausible understandings of what it is to minimize inaccuracy, inaccuracy minimizing considerations actually favor IBE over Bayes' rule. However, in the same work it was shown that in one sense of inaccuracy minimization – expressed in terms of average incurred penalties as measured by some standard scoring rule – Bayes' rule does outperform IBE, at least in a particular statistical model. In my talk, I discuss new work that compares IBE with Bayes' rule in a social setting. A variant of the Hegselmann-Krause model will be used to show that if agents do not only update their degrees of belief on the basis of evidence but also take into account the degrees of belief of their epistemic peers, then the noted advantage of Bayesian updating disappears and IBE does better than Bayes' rule on every reasonable understanding of inaccuracy minimization.

Rainer Hegselmann (University of Bayreuth)
"Understanding epistemic grouping, networking and division of labour. What can simple macroscopic models do?"

In my talk I'll start with a minimalistic model of opinion dynamics, the so-called *bounded confidence model*. Then I present stepwise extensions. In the end we have a model with cognitive division of labor and different epistemic groups, all of them engaged in networking of all sorts. Some of the groups are seeking for the truth or try to climb upwards in cliffy epistemic landscapes. Other groups simply follow the truth seekers and climbers. – As a result we get a simulator that allows, for instance, to analyse cost and benefits of networking and grouping, measured in terms of societal distance to the truth.

Cédric Patternotte (LMU, Munich Center for Mathematical Philosophy, Germany)
"Scientific virtues as catalysts"

There is a tension between virtue epistemology, according to which scientists should share identical

intellectual virtues, and recent results suggesting that diversity is beneficial to science. The latter claim is further motivated by normative reasons and historical examples of beneficial vices. I argue that uniform virtues can play a specific role in science while being neither necessary nor sufficient for scientific success. I provide a list of relevant intellectual virtues as well as definitions of their roles in the context of theory choice. I then distinguish between the activities of theory creation, which requires diversification, and of theory refinement, which requires specialisation, and show that intellectual virtues are akin to catalysts: they improve the odds of scientific success in the presence of the right ingredients. I conclude that uniform virtues improve the odds that scientists converge on a successful theory, provided that promising enough theories have already been discovered.

Carlo Proietti (Lund University, Sweden)
"Herd behavior and reasoning about other minds"

Research in social psychology displays many *prima facie* irrational phenomena of herd behavior and groupthink. Typically, when individuals make their choices based on the explicit behavior of other members of their group, one may end up with a suboptimal - or even catastrophic - collective and individual outcome. Informational cascades, pluralistic ignorance and belief polarization are characteristic examples of such dynamics. Their emergence has also been explained and reproduced via computer simulations along the pattern of "contagion" models (see "The emperor's dilemma" by Centola et al.). However, most of these explanations disregard the role of higher order beliefs, i.e. individual attitudes about others' reasoning patterns. How could we eventually assess their impact on complex social processes? Here we outline some possible answers.

Andrea Scharnhorst (DANS, Royal Netherlands Academy of Arts and Sciences (KNAW), The Hague, The Netherlands)

Since digitization and web technologies we seem to have any information under our fingertips. But a closer look reveals that although we might not need to go physically to a library or archive anymore, but it remains a time consuming, resource eating process to compose an overview, a literature review, a syllabus, or insights in current scientific trends from bits and pieces of information scattered around.

That all resources are digital available does not make the task always easier. This reveals a story told by Dr. Mathieu d'Aquin from the Open University, founded to provide university-level study to everybody. Television was among their first new technologies used and so a strategic partnership with BBC emerged which is still in place. They find it increasingly difficult to actually (re)find what material they have (e.g. in the BBC archive) and what information aggregation had already taking place. Too much data silos! They joined the LinkedUp project (an FP7 project http://linkedup-project.eu/) and started to semantically index their different databases, so that machines can help in the process of finding and linking.

Indeed is semantic web technology currently the most promising technology concerning knowledge management, processing and aggregating. Application-wise, knowledge discovery and knowledge aggregation in the areas of bio-medical information and health care are very hot with manyprojects and a lot of competition (see getutopia.com international; data2semantics.org national as examples). In this area, the focus is next to finding information about the academic discourse, patents and clinical practices, also on a finer-grained indexing than pointers to resources. In other words next to the "where" also the "what in detail" information get's indexed, retrieved and recombined. At the end a fabric of knowledge emergeswhich entails bit and pieces from genetic coding over the metabolic engines up to clinical trials and patient context. Nanopublications, PDF annotation tools, grass-rooted ontologies building are buzz-words in this area which booms for

good societal reasons – health care and its costs. But there are more mundane areas of knowledge acquisition which would equally profit from a concerted action of news ways of knowledge representation, visual analytics and interactive interfaces to knowledge management. This paper addresses this needs, discusses ideas and sketches of knowledge maps. It does on the ground of a newly started COST Action KnowEscape, which focal point is to develop visual enhanced browsing principles for mastering the information flood.

Krist Vaesen (Eindhoven University of Technology, The Netherlands)
"Cultural evolutionary theory and the collective dimensions of science"

Recently, sociologists and philosophers of science have deployed cultural evolutionary models in an attempt to explain how the collective work of scientists may occasion scientific progress. In my talk, I show these explanations to be premature, since they are based on non-robust model results; and since they follow from a particular, contestable construal of what it is that needs to be explained. Still, in a third more constructive part, I highlight the sense in which cultural evolutionary models may be adapted so as to become useful for our understanding of science.