

A Global Network for Modeling in the Social and Behavioral Sciences

2. Summary

Models and simulations play an increasingly important role in the social and behavioral sciences (see Humphreys 2006 and Hartmann and Sprenger 2009 for reviews). This raises several philosophical questions regarding their scope and limits. Three of these questions will be addressed in the present project: (i) How do qualitative and quantitative models compare? (ii) Can reductionistic models account for emergent social phenomena? (iii) Can we give representation-free accounts of cognitive abilities?

The members of this planned network, all leaders in their field, have been working on models and simulations for several years and addressed the subject matter from different, though related directions. Diez, Frigg and Hartmann have worked on scientific models and representations from the perspective of general philosophy of science and the philosophy of physics, Dubucs, Humphreys and Hartmann worked on the methodology of computer simulations with an eye on the social sciences and the role of statistics and probability in these sciences. Dubucs and Humphreys worked on models and emergence with an eye on the cognitive sciences, and Hartmann and Humphreys worked on reductionism and developed models of reduction.

The present project brings these strands of research together and makes them relevant for each other, which will help to advance and to boost work on models and simulations in the social and behavioral sciences, a topic which is still too much focused on the natural sciences, especially physics. We focus on three methodological questions and address them by using the toolkit of philosophy of science (case studies, conceptual analysis). The results of the project will not only advance an area within philosophy of science: they will also be relevant for the practice of modeling in the social and behavioral sciences.

Our work has already generated considerable international interest. Moreover, a lot of informal exchange took already place. This exchange should be consolidated into a more stable and enduring structure for facilitating research. In this proposal we apply for the funding of a small network with nodes in Barcelona, Charlottesville, London, Paris and Tilburg. The aim of the network consists in further research on modeling in the social and behavioral sciences and disseminating the results of this research through workshops, conferences and publications. Therefore, we kindly apply for funding of scholarly exchange, four workshops, publications, and the work needed to write an EU proposal dedicated to establishing a network for training researchers in an important and thriving branch of general philosophy of science and the philosophy of social and behavioral sciences.

3. Main Applicant

Stephan Hartmann
Tilburg Center for Logic and Philosophy of Science (TiLPS)
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4. Institutional Setting

The group applying for this grant is the Tilburg Center for Logic and Philosophy of Science (TiLPS) at Tilburg University. Tilburg University is a major research institution with a focus on economics, the humanities, law, and the social and behavioural sciences. TiLPS is devoted to the study of logic and philosophy of science in all its forms. Founded in May 2007, its first activity included a workshop on *Methodological Problems of the Social Sciences*, reflecting a particular interest in the philosophical problems of economics and the social and behavioral sciences. TiLPS has currently 17 members, including four PhD students and two visiting fellows; the most relevant researchers for the present project are Prof. Stephan Hartmann (formal philosophy, modeling, philosophy of economics), Dr. Maurice Schouten (Assistant Professor; philosophy of cognitive science, reductionism) and Dr. Jan Sprenger (Assistant Professor; modeling, philosophy of statistics).

5. Period

1 January 2010- 31 December 2012

6. Resubmitted Proposal

N.A.

7. Continuation of a Former Proposal

N.A.

8. Foreign Research Groups

Barcelona. University of Barcelona. Department of Logic, History and Philosophy of Science. LOGOS Research Group in Language and Cognition.

The University of Barcelona is the top ranked Spanish university. With more than 60,000 students, it offers graduate, master, doctoral and professional degrees in natural and social sciences, humanities, and engineering. The LOGOS Research Group is one of the most acknowledged and active groups on analytic philosophy in Europe, with six founded research projects on philosophy of language, philosophy of language and philosophy of science. José Díez is professor of Logic and Philosophy of Science at the University of Barcelona and one of the founding members of LOGOS. His research areas are measurement theories, structuralist approaches, scientific representation, theoretical concepts and scientific explanation. He has published three books and numerous papers in international journals and books. Díez's group includes M. Martínez and D. Pineda and has close links to other researchers in Europe (R. Frigg, C. Moulines, and J. Reiss), all working in modeling and representation in the sciences.

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Charlottesville, VA, USA. The University of Virginia. Department of Philosophy.

The University of Virginia is one of the United States' oldest public universities and was founded in 1819 by Thomas Jefferson. It is regularly ranked as one of the top two public universities, along with the University of California at Berkeley. Paul Humphreys is Professor of Philosophy and an editorial board member of a number of journals, including area editor for general philosophy of science at *Synthese*; editor-in-chief of the book series *Oxford Studies in the Philosophy of Science*; and a member of the National Board of Officers of the American Philosophical Association. He has served as the philosophy faculty member on the supervisory board of the University's cognitive science program since its founding in 1990 and participates in a number of collaborative research projects within UVA, nationally and internationally, ranging from computational science through causation to emergence. His research group for 2009-2010 will consist of two post-graduate students and a post-doctoral student.

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London, UK. The London School of Economics. Department of Philosophy, Logic and Scientific Method. The LSE is one of the most renowned universities in the world. Like Tilburg University, it focuses on economics and the social sciences. The Department of Philosophy, Logic and Scientific Method, which was founded by Sir Karl Popper, has a strength in the philosophy of social sciences and in general philosophy of science. Roman Frigg is a Senior Lecturer in this department. He works on scientific modeling and representation and related topics. Other members of this department, who are relevant for the present project, include J. Alexander, N. Cartwright, and M. Morgan.

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Paris, France. Institute d'Histoire et de Philosophie des Sciences et des Techniques.
The IHPST was founded in 1932 and is part of the Université de Paris I. It covers all aspects of the philosophy of the natural and social sciences, with a focus on the history and philosophy of the natural and social sciences, logic and decision theory. Prof. Jacques Dubucs is a former fellow of Ecole Normal Supérieur and the director of the IHPST. His work focuses on philosophical logic and the foundations of probability. He is also involved in a joint project with the University of Konstanz on the philosophy of causation. Other members of the IHPST, who are relevant for this project, include D. Andler, A. Barberousse, I. Drouet, S. Francescella, P. Huneman, and C. Imbert.

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9. Description of the Project

While there is a lot of literature on models and simulations in general (see Frigg and Hartmann 2006 for a review), there is much less literature that explicitly focuses on the social sciences. This raises the question whether there is anything special about modeling and simulation strategies and the role of these approaches in the social sciences. To address this question, the members of the present team have already conducted work on reduction and emergence (Hartmann, Humphreys), on the use of mathematics and statistics in the social sciences (Hartmann, Humphreys, Sprenger), models and representation (Diez, Frigg), simulations in the social sciences (Hartmann, Humphreys) and are well placed to advance this brand of research. Our project extends this work in several directions:

- (i) *Qualitative vs. quantitative models.* In the social sciences, statistical methods gain more and more terrain. Consequently, the methodology of specifying, analyzing and evaluating statistical models becomes more and more central, as witnessed by the increasing amount of literature in psychology and economics devoted to that topic

(Hartmann and Sprenger 2009). Such statistical models are also used for causal inference. On the other hand, there is a growing school of social scientists who urge that the dominant quantitative methods of causal inference must be supplemented by qualitative modes of inference that appeal to mechanisms (Humphreys 2002). The core issue in so-called automated causal inference is how much in the way of identifying causal variables and causal relations can be achieved using only empirical data (Freedman and Humphreys 1999). More specifically, the project would investigate the justification for using the Neyman-Holland-Rubin method of counterfactual inference in statistics and explore the use of conclusions from that method in policy interventions for social goals. Furthermore, statistical models that are based on theoretical understanding and structural equations are increasingly replaced by simulation-based methods (e.g. resampling) where modeling assumptions are kept to a minimum (Sprenger 2009). In particular, *qualitative* assumptions, such as independence, are used instead of specific parametric models. We would like to explore to what extent statistical inference based on such qualitative assumptions can yield reliable policy. This project will be conducted by the Tilburg group (Hartmann, Sprenger) and the Charlottesville group (Humphreys), building on some of our earlier work.

- (ii) *Reduction and emergence.* This topic cuts across almost all sciences. After a period in which most attention was focused on the possibilities of reducing mental phenomena to physical, there is considerable interest in these issues as they affect statistical mechanics, complex systems, artificial life, and computational theory. The proposed research topic in this area is to examine the special features of representation, prediction, and explanation that agent based simulations can provide, compared to traditional system level equation based models (Humphreys 2004). This is an issue of methodological interest in areas ranging from economics to biology. Agent based models capture much of what methodological individualists have wanted in the social sciences but they also produce emergent patterns that are best interpreted as representing system-wide features (Barberousse et al. 2009, Humphreys 2009). The primary goal of the research would be to explore how concepts are developed to best exploit the system-wide representations while preserving the understanding gained from using the individualist methods of the agent based models. Particular attention would be paid to how representations of heterogeneous agent properties can best be captured by object-oriented programming methods, as opposed to the more traditional representations used by systemic programming. This project will be conducted by the Charlottesville group (Humphreys), the LSE group (Frigg), the Paris group (Barberousse, Dubucs, Huneman, Imbert) and the Tilburg group (Hartmann, Schouten), building on some of our earlier work.
- (iii) *Representational vs. non-representational models.* There has been interest in recent years within cognitive science of exploiting the results from dynamical systems theory to provide representation-free accounts of cognitive abilities (Frigg 2005). These serve as alternatives

to the intentional accounts of traditional artificial intelligence and the sub-conceptual representations of neural nets (Diez 1999). As with the emergent features but using different methods, the dynamical systems approach seems to hold out the promise of avoiding the problem of original intentionality, which lies at the heart of all representational schemes. This project will be conducted by the Barcelona group (Diez, Martinez, Pineda), the Charlottesville group (Humphreys) and the LSE group (Frigg), building on some of our earlier work.

Meanwhile a loose network of researchers working on models and simulations in the social and behavioral sciences has established itself. The usual informal contacts are maintained and researchers meet as a result of existing workshops and conferences.

	CONFERENCES
2001-07	Philosophy, Probability and Physics Workshops, first Konstanz-Paris, then London-Paris; Dubucs, Frigg, Hartmann
2003	On Wesley Salmon's Work, in Barcelona, organized by Diez, Humphreys attends
2004	Spaces and Constraints, in Oxford; Hartmann and Humphreys
2007	Models and Simulations 1, in Paris, organized by Frigg, Hartmann and Imbert. Humphreys is an invited speaker. Edition of a special issue of <i>Synthese</i> .
Biyearly, since 2007	Conferences of the European Philosophy of Science Association, in Madrid, Diez, Dubucs, Hartmann
Yearly, since 2007	London-Paris-Tilburg Workshops in Logic and Philosophy of Science
2007	Scientific Models, in Barcelona, organized by Diez and Frigg
2006	Probabilities, Causes and Propensities in Physics Workshop, in Madrid, Dubucs, Frigg and Hartmann
2007	Models and Simulations 2, in Tilburg, organized by Frigg, Hartmann and Imbert. Humphreys attends. Edition of a the special issue of <i>Synthese</i> .
2009	Models and Simulations 3 in Charlottesville, organized by Hartmann, Humphreys and Weisberg. Frigg is on the program committee.

	EXCHANGE VISITS
2001	Hartmann in Charlottesville
2003	Humphreys at the LSE (on Frigg's PhD committee)
2005	Diez at the LSE
2005	Humphreys in Paris
2006	Diez at the LSE
2006-07	Frigg in Barcelona
2007	Hartmann in Paris
2007	Frigg and Humphreys in Tilburg
2007	Humphreys at the LSE
2008	Humphreys in Paris

2008	Frigg in Tilburg
2008	Hartmann in Barcelona
2008	Frigg in Barcelona
2009	Hartmann at the LSE
2009	Hartmann in Paris
2009	Diez at the LSE

From 2003-07, Frigg and Hartmann were colleagues at the LSE and started to collaborate. From 2006-08, Diez directed a research project on “Explanation and Representation in Science: Pragmatic and Structural Aspects” in which Roman Frigg and two other members of his group participated. There is a follow-up to this project (from 2009-2011) on “Explanation and Representation: Functional and Inherentist Approaches”. Some of the funding that the Barcelona group committed to the present project application comes from this project. Humphreys co-edited a special issue of *Minds and Machines* with Philippe Huneman (Paris) and served as an external examiner on various Ph.D. dissertations at the IHPST.

Planning and Description of Activities.

The geographical distances between the four nodes of the proposed network has made regular face-to-face interaction between researchers difficult to realize and funding for travel and for establishing a series of workshops would be especially welcome. We propose the funding of:

- *Five workshops*, one at each of the nodes. The first workshop on *Qualitative vs. Quantitative Models in the Social Sciences* will take place in Tilburg in early 2010 and a workshop on *Computational Models of Emergent Phenomena* is planned in Paris in December 2010. Further workshops are planned in Barcelona, Charlottesville and London.
- *Exchange of scholars*. We plan for five short periods in which scholars from all five nodes stay at one location, where they can engage in collaborative research. The most practical way to organize this is in conjunction with the workshops. There will also be short stays of one researcher in the institution of another researcher to intensively work on a joint project. Our PhD students will also be involved in the collaboration.
- *Joint Publications*. Hartmann and Humphreys will edit a book on *Modeling in the Social and Behavioral Sciences*, which will be submitted to a major publisher. Initial steps for this project are taken, and the main work (i.e. writing a book proposal and assembling a list of contributors) will be done in 2010. We also plan at least one two-authored joint article per year, which will be published in a peer-reviewed journal. Diez, Frigg and Hartmann have already made the steps in this direction.
- *Writing Research Proposals*: We will write a proposal for and Initial Training Network, 7th Framework program. This proposal will be designed in 2010. The application is planned for 2011 and will involve other partners, such as the Universities of Amsterdam and Rotterdam, the Universities of Bielefeld and Hamburg in Germany, Harvard University, and the Universities of Philadelphia, Pittsburgh and South Carolina in the US. We will also apply for at least one Marie Curie Fellowship and encourage advanced PhD students in

all four foreign nodes to apply for schemes such as the NWO's Rubicon and Veni programs. Hartmann, who is Vice president of the European Philosophy of Science Association (EPSA) and Team Leader of a research group of the ESF program *The Philosophy of Science in a European Perspective*, will also involve EPSA and the ESF program.

All researchers involved have a large network of contacts and collaborators, which will be used in the project. The program is *relevant* not only for philosophy, but also for a better understanding of the social sciences. Frigg will bring in his recent work on climate change and its implications, Humphreys his work on agent-based models, and Hartmann his work on models of socio-political decision-making. The project is *feasible* as it builds on the competences of all researchers involved, and as it is grounded in work which has already been done by the members of the network. We believe that the network will increase the visibility of all groups involved. TiLPS hopes to sharpen its profile as a first-rate place for the methodology of the social and behavioral sciences.

Program Coherence. The program centers around models and simulations in the social and behavioral sciences, and this focus lends it coherence. Though the study of models and simulations in science is a relatively well-established research field, little relevant research has been done on their application in the social and behavioral sciences. The work of the network will focus on three central and rather unexplored research areas that will stimulate further questions.

Quality of the Group Involved. All researchers involved are leaders in the relevant research areas and published already important work.

Added Value of the Cooperation. While it would be theoretically possible for each group involved to work out some of its ideas in isolation, we feel that cooperation and more interaction will greatly enhance the results. Combining the various expertises of the five members of the planned network will help to achieve substantial results. Our ambitions thus are high and the scope of the project we envision is too large for any of our groups. Cooperation will be necessary to make any inroads here.

While the present project focuses on methodological issues, the TiLPS group is involved in another project (supported by an Internationalisation Grant from the NWO from 2009-2011), which focuses on *Formal Models in Social Epistemology*. The scholars involved in that project construct models and perform computer simulations, while the present project focuses on methodological questions. We believe that both projects will complement each other and that the methodological competence from the present project will be helpful for the work on the other project. Moreover, some of the scholars involved in the *Formal Models* project also have an interest in methodological questions around models in science (Colyvan, Weisberg) and we assume that they will also add value to this project.

References:

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10. Number of Words of Section 9 (excluding references)

1928

11. Results

The following results will be obtained:

- *An International Research Network*. The network will have a permanent character, with nodes in Barcelona, Charlottesville, London, Paris and Tilburg.
- *A Proposal* for an Initial Training Network.
- *Publications*. Several joint papers, to be published in international peer-reviewed journals, and a volume on *Modeling in the Social and Behavioral Sciences*, ed. by Hartmann and Humphreys.

12. Short Vita of Stephan Hartmann

Full name: Stephan Hartmann
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8.1 Education and Qualification

Ph.D. in Philosophy: University of Giessen (1995)
M.A. (“Magister”) in Philosophy: University of Giessen (1991)
M.Sc. (“Diplom”) in Physics: University of Giessen (1991)
B.A. (“Zwischenprüfung”) in Philosophy: University of Giessen (1989)
B.Sc. (“Vordiplom”) in Physics: University of Giessen (1989)

8.2 Career

Team Leader (of Team A: *Formal Methods in Philosophy of Science*) of the ESF network program *The Philosophy of Science in a European Perspective* (2008-2012)
Vice President, European Philosophy of Science Association (2007-2009)
Professor of Philosophy, Department of Philosophy, Logic and Scientific Method, London School of Economics (2006-2007)
Visiting Professor, Department of Logic and Philosophy of Science, University of California at Irvine (Winter 2006)

Reader, Department of Philosophy, Logic and Scientific Method, LSE (2005-2006)
 Director, Centre for Philosophy of Natural and Social Science, LSE (2004-2006)
 Lecturer, Department of Philosophy, Logic and Scientific Method, LSE (2003-2005)
 Director, Research Group Philosophy, Probability and Modeling, University of
 Konstanz (2002-2005)
 Assistant Professor, Department of Philosophy, University of Konstanz (1998-2003)
 Fellow, Center for Philosophy of Science, University of Pittsburgh (2000-01)
 Research Scientist, Department of Physics, University of Munich (1996-98)
 Lecturer in Philosophy, University of Giessen (1997-98)
 Lecturer in Philosophy, University of Konstanz (1996-98)
 Visiting Scholar, Department of Physics, University of Washington (1991-92)

8.3. Selected Publications

- Bayesian Epistemology* (with Luc Bovens). Oxford: Oxford University Press 2003.
 German translation: Paderborn: mentis-Verlag 2006.
- Nancy Cartwright's Philosophy of Science (ed. with Carl Hoefer and Luc Bovens).
 London: Routledge 2008.
- Modeling High-Temperature Superconductors: Correspondence at Bay?, in: L. Soler,
 H. Sankey and P. Hoyningen-Huene (eds.), *Rethinking Scientific Change.
 Stabilities, Ruptures, Incommensurabilities?* Berlin: Springer 2008, 107-128.
- Models in Science (with Roman Frigg), in: *The Stanford Encyclopedia of Philosophy*,
 (Spring 2006 Edition).
- Modeling Partially Reliable Information Sources: A General Approach Based on
 Dempster-Shafer Theory (with Rolf Haenni), *Information Fusion* 7: 361-379
 (2006).
- A Utilitarian Assessment of Alternative Decision Rules in the Council of Ministers
 (with Claus Beisbart and Luc Bovens), *European Union Politics* 6(4): 395-419
 (2005).
- Solving the Riddle of Coherence (with Luc Bovens), *Mind* 112: 601-634 (2003).
- Bayesian Networks and the Problem of Unreliable Instruments (with Luc Bovens),
Philosophy of Science 69: 29-72 (2002).
- On Correspondence, *Studies in History and Philosophy of Modern Physics* 33B, 79-
 94 (2002).
- Effective Field Theories, Reduction and Scientific Explanation, *Studies in History
 and Philosophy of Modern Physics* 32B, 267-304 (2001).
- Models and Stories in Hadron Physics, in: M. Morgan and M. Morrison (eds.),
Models as Mediators, Cambridge: Cambridge University Press 1999, 326-346.
- The World as a Process: Simulations in the Natural and Social Sciences, in: R.
 Hegselmann et al. (eds.), *Modelling and Simulation in the Social Sciences from
 the Philosophy of Science Point of View*. Dordrecht: Kluwer 1996, 77-100.
- Models as a Tool for Theory Construction: Some Strategies of Preliminary Physics,
 in: W. Herfel et al. (eds.), *Theories and Models in Scientific Processes*.
 Amsterdam: Rodopi 1995, 49-67.

13. Budget

Exchange of scholars: € 27,000

Setting up a network:	€ 8,000
Five workshops:	€ 25,000
Publications	€ 3,000
Writing a research proposal (buy out):	€ 10,000
 Total:	 € 73,000

The Barcelona node will contribute € 6,000, the Charlottesville node will contribute US\$ 6000 (€ 4773), the London node will contribute € 2,000 and the Paris node will contribute € 7,000, with a total of € 19,773 (= 27% of the total budget). We ask the NWO to contribute the remaining € 51,250.

N.B.: Roman Frigg is involved in a project at Barcelona from which some of the Barcelona funding comes from. So Barcelona and London jointly contribute € 8,000.