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Roman Frigg, LSE
Stephan Hartmann, LSE
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Cyrille Imbert, IHPST
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Models and Simulations

Paris, France – Monday 12 June - Tuesday 13 June, 2006

Invited conferences

Paul Humphreys: "Some Methodological Issues in Computer Simulations"

Robert Batterman: "Idealization and Modeling"

Organizers

Roman Frigg, LSE, Stephan Hartmann, LSE, Cyrille Imbert, IHPST

Comments / Notes

Models and Simulations

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Invited conferences

Paul Humphreys

"Some Methodological Issues in Computer Simulations"

Robert Batterman

"Idealization and Modeling"

16 sessions, 31 talks

Organizers :

Roman Frigg, LSE
Stephan Hartmann, LSE
Cyrille Imbert, IHPST

Organizing institutions

Institut d'Histoire des Sciences et des Techniques (CNRS)

Centre for Philosophy of Natural and Social Sciences (LSE)

Day 1, morning

9.00-9.15 Welcome and Introduction

Parallel session 1

1A: Defining Simulations (1)
chair: Stephan Hartmann

9.15-10.00 Ulrich KROHS

"A Priori Measurable Worlds"

10.00-10.45 Gianluca PARONITTI

"Simulation as Epistemic Equivalence"

1B: Simulations in the Life Sciences and Chemistry (1)
chair: Pierre-Alain Braillard

9.15-10.00 Andrea LOETTGERS

"Reconstructing Versus Simulating"

10.00-10.45 Bert LEURIDAN

"Models and Simulations without Computers. The Case of Galton's Hereditary Machine"

Coffee Break

Parallel session 2

2A: Defining Simulations (2)
chair: Anouk Barberousse

11.15-12.00 John SIMPSONS

"Simulations Are Not Models"

12.00-12.45 Sonja SMETS

"Comparing Processes: from Simulations to Bisimulations"

2B: Simulations in the Life Sciences and Chemistry (2)
chair: Ulrich Krohs

11.15-12.00 Francis MARCHESE

"Abstraction, Design and the Synthesis of (Molecular) Objects"

12.00-12.45 Pio GARCIA

"Beyond the Dichotomy In Vivo-In Vitro: in Silico"

Lunch

Comments / Notes

Comments / Notes

Day 1, afternoon

Parallel session 3

3A: Simulation as Experiments
chair: Eric Winsberg

14.00-14.45 Anouk BARBEROUSSE

"Computer Simulations as Experiments"

14.45-15.30 Jean-Frédéric DE PASQUALE

"What does it Mean to Say that Simulations are Thought Experiments? An Application of Dennett's Thesis to Evolutionary Connectionism"

3B: Explanation in Game Theory
chair: Meinard Kuhlmann

14.00-14.45 Paul WEIRICH

"Computer Simulations in Game Theory"

14.45-15.30 Arnold ECKHART

"The Dark Side of the Force: When Computer Simulations Lead Us Astray and 'Model Think' Narrows our Imagination"

Coffee Break

Parallel session 4

4A: Explanation and Simulation
chair: James Mattingly

16.00-16.45 Cyrille IMBERT

"Can Simulations Be Explanatory?"

16.45-17.30 Till GRUENE-YANOFF

"Agent-Based Simulation, Generative Science, and its Explanatory Claims"

4B: Economics
chair: Paul Weirich

16.00-16.45 Alessio MONETA

"Empirical Validation of Simulation Models in Economics: Methodological Issues and Open Problems"

16.45-17.30 Meinard KUHLMANN

"How do Microscopic Models of Financial Market Explain"

Coffee Break

18.00-19.00 Plenary session 1: Invited lecture by Paul Humphreys

chair: Cyrille Imbert

"Some Methodological Issues in Computer Simulations"

Conference Dinner at 20.00

Day 2, morning

Parallel session 5

5A: Epistemology of Simulation
chair: Paul Humphreys

9.15-10.00 Julian REISS

"Three Theses Regarding the Epistemology of Simulations"

10.00-10.45 Axel GELFERT

"Simulating Many-Body Systems: the Epistemic Role of Cross-Model Justification"

5B: Cognitive Science, Psychology and Artificial Intelligence (1)
chair: Claus Beisbart

9.15-10.00 Aziz ZAMBAK

"M-S Model. A New Approach to Models and Simulations in Artificial Intelligence"

10.00-10.45 Dirk SCHLIMM

"From 'Psychic Machines' to Neural Networks: Learning from Models and Computer Simulations in Psychology"

Coffee Break

Parallel session 6

6A: Artifacts and Fictions in Physics
chair: Alisa Bokulich

11.15-12.00 Eric WINSBERG

"A Function for Fictions Expanding the Scope of Science"

12.00-12.45 James MATTINGLY

"Artifacts and Analogues in Physics Simulations: Computational versus Physical Models"

6B: Cognitive Science, Psychology and Artificial Intelligence (2)
chair: Axel Gelfert

11.15-12.00 Manuel DE PINEDO and Jason NOBLE

"Beyond Persons: Extending the Personal/Subpersonal Distinction to Non-Rational Animals and Artificial Agents"

12.00-12.45

Lunch

Comments / Notes

Information for the conference dinner

(Monday 12 June, 8 PM)

Place: Restaurant l'Equitable
1 rue des Fossés Saint-Marcel
75005 Paris

Price: 38 euros, everything included

How to get there:

From the conference place, take line 7 to metro Gobelins.
Take boulevard Saint-Marcel.
Take rue des Fossés Saint-Marcel (third street on the left).
The restaurant is at the end of this street.

Menu:

Apéritif maison (crème de griotte, cerise, pétillant brut)
et ses mises en bouches

entrée

Salade de tourteau à la julienne de légumes sauce olive au basilic, sorbet tomate

plat

Magret de canard en croûte de coriandre, semoule au parfum de genièvre et d'orange

dessert au choix

Vin rouge Côtes de Bourg Château Tuileries Gouribon 2004 (Cheval Quancard)

Café et meringues

Day 2, afternoon

Parallel session 7

7A: Dynamical Systems
chair: Robert Batterman

14.00-14.45 Sara FRANCESCHELLI
"Numerical Experimentation, Dynamical Systems, and Novelty"

14.45-15.30 Matt PARKER
"Computing the Uncomputable or The Discrete Charm of Second-Order Simulacra"

7B: Dealing with Complexity
chair: Michael Stöltzner

14.00-14.45 Johannes LENHARD
"Controlling Complex Phenomena with the Help of Opaque Models"

14.45-15.30 Soufian BEN AMOR
"Percolation, Pretopology and Complex Systems Modeling"

Coffee Break

Parallel session 8

8A: Quantum Computation and Quantum Physics Issues
chair: Sonja Smets

16.00-16.45 Michael STÖLTZNER
"Can We Extend Ourselves to the Nano-World"

16.45-17.30 Alisa BOKULICH
"Wavefunction Scarring and the Function of Models in Simulations and Experiments"

8B: Cosmology
chair: Matt Parker

16.00-16.45 Stéphanie RUPHY
"Learning from a Simulated Universe: the Limits of Virtual Experiments in Astrophysics and Cosmology"

16.45-17.30 Claus BEISBART
"Do Computer Simulations Change the Way Physics Works"

Coffee Break

18.00-19.00 Plenary session 2: Invited lecture by Robert Batterman
chair: Roman Frigg

"Idealization and Modeling"

Abstracts of participants

1A- DEFINING SIMULATIONS (1)

A PRIORI MEASURABLE WORLDS

Ulrich Krohs, Konrad Lorenz Institute for Evolution & Cognition Research, Altenberg, and Philosophy Department, University of Hamburg.

Part of the scientific enterprise is to measure the material world and to explain its dynamics by means of models. However, not only is measurability of the world limited, analyzability of models is so, too. The way out of this epistemic bottleneck is most often to run computer simulations. I regard a simulation as a kind of a “non-material scale model” of the material world. Like any other scale model, it does not per se give any scientific explanation but is first in itself an object of scientific enquiry, a world. Since this world is numerical, it is a priori measurable. Its role in scientific explanation will be discussed.

SIMULATION AS EPISTEMIC EQUIVALENCE

Gianluca Paronitti

My aim is to redefine the concept of simulation. Bypassing the standard view which considers simulation as a model animated by any updating function, I argue that simulation is a relation between a simulator and a simulated system which are represented by the epistemic agents at different levels of abstraction. As a consequence, I propose that one can refine the equivalence relation between two systems by explicating the simulation relation and the levels of abstraction at which an epistemic agent is observing them. This refinement of the equivalence relation clarifies many philosophical problems that depend on elaborating criteria for comparing systems.

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1B- Simulations in the Life Sciences and Chemistry (1)

Reconstructing versus Simulating

Andrea Loettgers, Harvey Mudd College

In biological organisms the interaction among genes and proteins, forming genetic circuits, gives rise to specific functions such as the circadian clock in Drosophila cells which regulate the day/night cycles. By implementing the synthetic models in E.Coli cells, for example, synthetic biologists use these models as in vivo models and try to explore the regulating mechanism of genetic circuits. Different from simulations, which, according to Stephan Hartmann, imitate one process by another process, synthetic biologists aim to replicate the process. What makes the replication approach a more appropriate one for the investigation of biological organism then abstract mathematical models and computer simulations?

Models and Simulations without Computers. The Case of Galton's Hereditary Machine.

Bert Leuridan, Research Assistant of the Research Foundation - Flanders (FWO - Vlaanderen), Centre for Logic and Philosophy of Science, Ghent University, Belgium

At the end of the 19th century, Francis Galton, the famous biometrician, invented an ingenious mechanical machine which in some senses resembled present-day computer simulations. It served as a rhetoric tool in the exposition of his theory of heredity: it elucidated the modern statistical concepts used and it served as an instrument for forecasting human stature.
I will use this example to tackle the topic of realism/instrumentalism w.r.t. simulations. Galton’s machine can be used by the instrumentalist for the prediction or simulation of empirical regularities (cf. the later biometrician Karl Pearson). Francis Galton, however, sought a realistic causal explanation, a kind of ‘genetics’.

2A- DEFINING SIMULATIONS (2)

SIMULATIONS ARE NOT MODELS

John Simpson

The aim of this paper is to argue that simulation is the activity of inferring future states. I argue that simulations instantiate models and that models are complexes of representations, so the inference in question makes use of the relations between the representations in the simulation's associated model. It follows that simulations should not be properly considered to be models in general, despite it being the case that they are commonly treated or referred to as being models, or even models of a special type, namely dynamic models. Further consequences of this position are also discussed.

COMPARING PROCESSES : FROM SIMULATIONS TO BISIMULATIONS

Sonja Smets, CPNSS London School of Economics and Vrije Universiteit Brussel

The notion of simulation as a relation between processes or dynamic models is standard in theoretical computer science as well as in modal logic. However, in philosophy and the social sciences, simulations are often identified with the image of this relation and are viewed as a process or model itself. In this talk I will focus on the logical connection between these two notions of simulations. In particular, I will discuss the relation between simulations, bisimulations, models and processes in modal logic. And I use logical so-called (bi)simulation games to explain the operational character of the (bi)simulation relations. I will conclude with some remarks about the importance of (bi)simulations in logic today.

8B- COSMOLOGY

LEARNING FROM A SIMULATED UNIVERSE: THE LIMITS OF VIRTUAL EXPERIMENTS IN ASTROPHYSICS AND COSMOLOGY

Stéphanie Ruphy, University of Provence, France

Through a case study in cosmology – a recent simulation of the evolution of the Universe - I will address the issue of the reliability and accuracy of the representations delivered by astrophysical models. I will explain how the fact that many free parameters in a cosmological model cannot get their values by means independent of the model leads to an inherent plurality of empirically successful models. An immediate consequence of this plurality is the contingency and “path-dependency” of the current dominant models. I will investigate to what extent this path-dependency hampers the realistic ambition of cosmological simulations and how it affects the possibility of using such simulations as virtual experiments.

DO COMPUTER SIMULATIONS CHANGE THE WAY PHYSICS WORKS?

Claus Beisbart, University of Dortmund

In this talk I argue that computer simulations have changed the way physics works in a fundamental way. My example is cosmology. My argument is based on a systematic reconstruction of the epistemological problems that are addressed simulations and the way simulations address these problems. The main reasons for my thesis are: 1. simulations come with their own ontology. 2. As a consequence, cosmologists need special principles to relate this ontologies to observations. In the last part of my talk I describe the way cosmology has been changed at the surface level.

8A- QUANTUM COMPUTATION AND QUANTUM PHYSICS ISSUES

CAN WE EXTEND OURSELVES TO THE NANO-WORLD

Michael Stöltzner, University of Wuppertal

This contribution investigates the consequences on our understanding of computer simulations in the empirical sciences that result from simulating processes in the nano-world and from using quantum computers in simulations. Both features, as speculative as they may appear today, pose interesting problems for a comprehensive account of computer simulations. My main thrust is that in virtue of the distinctive features of the quantum world it is difficult to distinguish a simulation from a simulated system. At this point, theories, such as the one recently outlined by Paul Humphreys, that rightly emphasize the actual physical nature of the computer simulation above and beyond the abstract computational model, have basically two options. Either they consider information as a new basic quantity of science. Or they consider a computer simulation as a model that mediates between an abstract computational template and real physical processes.

WAVEFUNCTION SCARRING AND THE FUNCTION OF MODELS IN SIMULATIONS AND EXPERIMENTS

Alisa Bokulich, Boston University

Classically chaotic billiard models, such as the stadium and Sinai billiards, have been at the forefront of research in semiclassical mechanics. Numerical simulations have revealed that surprising new phenomena, such as wavefunction scarring, occur in the quantum analog of these models. Although many of these quantum billiard systems have been physically realized in the lab, these models are not simply mediating between theory and experiment. As I shall show, these models are functioning in two surprising ways: first, they are playing an explanatory role, in accounting for the quantum phenomenon of wavefunction scarring, and second, they are functioning as the "target" system, which, in these lab experiments, the physical world is very carefully being contrived to simulate.

2B- SIMULATIONS IN THE LIFE SCIENCES AND CHEMISTRY (2)

ABSTRACTION, DESIGN, AND THE SYNTHESIS OF (MOLECULAR) OBJECTS

Francis T. Marchese, Computer Science Department, Pace University

We suggest that design notions of abstraction, modularity, and information hiding may be used to analyze the relationship between physical objects and software representations. Using molecular models and visualization systems as examples, we argue that, for molecules to be expressible in differing mediums whether they are atoms, human-scale physical models, painted imagery, or text rendered either as mathematical formulas or in computer programs, there must be underlying conceptual designs or patterns that map molecular information onto these disparate forms. Finally, we propose that these design principles may be used to create an equivalence relationship between physical objects and software representations.

BEYOND THE DICHOTOMY IN VIVO-IN VITRO: IN SILICO

Garcia Pio

3A- SIMULATIONS AS EXPERIMENTS

COMPUTER SIMULATIONS AS EXPERIMENTS

Anouk Barberousse (IHPST (CNRS – université Paris 1 – ENS)

Computer simulations may be analyzed as computer programs as they are run at particular times and places, namely as particulars, like field experiments. Moreover, contrary to a model, a simulation is completely determined, since every variable in the model must take a particular value in the simulation. Simulations are also designed to instantiate certain (mathematical) target properties and relations. The ontological status of simulations as particulars is the reason why they can be used as experiments and test theoretical hypotheses as well as generate data that are the basis for new theoretical investigations. The paper traces the epistemic value of simulations back to their similarity to field experiments.

WHAT DOES IT MEANS TO SAY THAT SIMULATIONS ARE THOUGHT EXPERIMENTS? AN APPLICATION OF DENNETT'S THESIS TO EVOLUTIONARY CONNECTIONISM

Jean-Frédéric de Pasquale, computer science, Université du Québec à Montréal

Evolutionary connectionist (EC) simulations combine genetic algorithms and neural networks. Because they are frequently used as biological models, we need an epistemology of EC modelling and simulation to understand exactly how these simulations can bring knowledge of the phenomena they model. Current theories of modelling and simulations from other fields do not seem appropriate to EC modelling. We will propose a tentative framework to understand the use of EC simulations as models, based on two intuitions: Dennett's thesis that simulations are thought experiments and Suppes' thesis that model in the modelling sense are models in the logical, semantic sense.

7B- DEALING WITH COMPLEXITY

CONTROLLING COMPLEX PHENOMENA WITH THE HELP OF OPAQUE MODELS

Johannes Lenhard, Universität Bielefeld

Simulation may manage to control complex phenomena although the models invoked remain epistemically opaque. Considering cases from astronomy and meteorology, it will be argued that simulation methodology is specifically adapted to deal with that epistemological challenge. While theory-based insight into the model's dynamics gets lost – be it for black-box elements, be it for complex interactions – acquaintance with model behavior is achieved in the course of the interactive use of experiments and visualizations. Thus simulation leads to a remarkable conception of modeling: epistemic lucidity resigns as the fundamental goal for mathematical modeling and as the key for controlling dynamics.

PERCOLATION, PRETOPOLOGY AND COMPLEX SYSTEMS MODELING

Soufian Ben Amor, Ivan Lavallée and Marc Bui, Complex Systems Modeling and Cognition Lab

A complex system is generally regarded as being a network of elements in mutual interactions, which total behavior cannot be deduced fromt hat of its parts and their properties. Thus, the study of a complex phenomenon requires a holistic approach considering the system in its totality. The aim of our approach is the design of a unifying theoretical framework to define complex systems according to their common properties and to tackle their modeling by generalizing percolation processes using pretopology theory.

7A- DYNAMICAL SYSTEMS

NUMERICAL EXPERIMENTATION, DYNAMICAL SYSTEMS, AND NOVELTY

Sara Franceschelli, ENS-LSH & REHSEIS

Simulation, under the form of numerical experimentation, can participate in the emergence of novelty in our knowledge in physics. I shall defend this claim by developing a case-study taken from the history of the application of the mathematical theory of dynamical systems to the study of transition to chaos in some experimental systems and by showing the role of the numerical exploration of the Lorenz system in this process. This example also shows that, in the field of dynamical systems, results and concepts that belong to the theory itself, namely genericity and structural stability, enable to justify the claim that mathematical models and simulations can play a mediating role between theory and experiment.

COMPUTING THE UNCOMPUTABLE, OR, THE DISCRETE CHARM OF SECOND-ORDER SIMULACRA

Matthew W. Parker, London School of Economics

We study an especially attenuated case of a "mediating model", in which computer simulations suggest that a certain model exhibits non-computable behaviour. These simulations are defended by reference to a simpler model of the model (hence "second-order simulacra"). We will see that this defence is problematic, but there are general reasons to believe the simulations are accurate. And though the models do not prove anything specific about an actual physical system, they influence our general expectations, and provide an essential component for any complete explanation of why and how the qualitative behaviour of some actual systems may be non-computable.

3B- EXPLANATION IN GAME THEORY

COMPUTER SIMULATIONS IN GAME THEORY

Paul Weirich, Philosophy Department, University of Missouri

A computer simulation runs a model generating a phenomenon to be explained. For the simulation to be explanatory, the model has to be explanatory. The model must be isomorphic to the system out of which the phenomenon emerges. I evaluate two simulations in game theory that are intended to be explanatory. The first is Skyrms's simulation of deliberational dynamics. It is intended to explain the emergence of a Nash equilibrium in a noncooperative game. The second is Skyrms's simulation of evolutionary dynamics. It is intended to explain the emergence of cooperative equilibria in both cooperative and noncooperative games.

THE DARK SIDE OF THE FORCE: WHEN COMPUTER SIMULATIONS LEAD US ASTRAY AND "MODEL THINK" NARROWS OUR IMAGINATION

Eckhart Arnold, University of Düsseldorf, Germany

This presentation attempts a critical examination of the conditions under which computer simulations are a useful tool to produce scientific explanations. Two criteria are proposed that a simulation must meet in order to be explanatory: 1) The simulation has to include *all* causally relevant factors of a given empirical configuration *and* (2) it must deliver stable results within the measurement in accuracies of the input parameters. As will be demonstrated by looking at a few examples of Axelrod-style simulations, computer simulations which do not meet these criteria not only fail to explain anything but may even have adverse effects on our understanding of the scientific problems that they have been addressed to solve.

4A- Explanation and Simulation

Can Simulations Be Explanatory?

Cyrille Imbert, Paris I/IHPST

I restrict in this paper to cases where one possess a good mathematical theory of a system and argue that being able to derive a property of the system from this theory is not enough to explain the property. A good explanation should select in the mathematical description of a system only those features that are necessary to derive the property: the requirements of relevance and minimality must be met in the derivation. I develop at length the example of a two-dimensional random walk where the Central Limit Theorem enables to determine which properties seem to be relevant for the explanation of a probability distribution characterizing the walk. Finally, I use this discussion to show that the explanatory status of simulations is case specific and that sometimes, simulations can indeed be explanatory.

Agent-Based Simulation, Generative Science, And Its Explanatory Claims

Till Grüne-Yanoff, Royal Institute of Technology, Stockholm

Generative simulation purports to explain social phenomena by 'growing' them computationally through cellular automata. This paper discusses how these simulations can explain. I distinguish between causal explanation, which cites an event's predominant cause, and constitutional explanation, which shows how a system's elements have the capacity to instantiate the system's properties. Due to the difficulty of structurally validating its model, generative simulation is not sufficient for causal explanation. More importantly, due to its methodological procedure, it is not necessary for causal explanation, either. Instead, generative simulations are necessary, and under certain circumstances sufficient, to explain a system's capacity to reach a certain state. This explanation differs both in explanandum and in explanans from causal explanations. Thus, generative stimulation can enhance our understanding of social phenomena – but in a way that is very different from causal understanding, and that has not received its due

6B- Cognitive Science, Psychology and Artificial Intelligence (2)

Beyond persons: Extending the personal / subpersonal distinction to non-rational animals and artificial agents

Manuel de Pinedo, University of Granada, Spain, and Jason Noble, University of Leeds, UK

There are several lines of defence for the need of two modes of explanation of agents' behaviour, one personal, one sub-personal. We highlight three: the ineliminability of reason-involving explanations, the necessary appeal to features of the agent's environment and the need for functional explanations. While we find much of interest on the first two lines, we concentrate on the third and argue in its favour using as an example minimally cognitive agents evolved using Artificial Life techniques. We then conclude that the agent / sub-agent distinction holds even if rationalization and externalistic arguments do not succeed in grounding it.

attention.

6A- ARTIFACTS AND FICTIONS IN PHYSICS

A FUNCTION FOR FICTIONS EXPANDING THE SCOPE OF SCIENCE

Winsberg Eric

ARTIFACTS AND ANALOGUES IN PHYSICS SIMULATIONS: COMPUTATIONAL VERSUS PHYSICAL MODELS

James Mattingly, Georgetown University Philosophy Department

Walter Warwick, Micro Analysis and Design

We investigate the relationship between two approaches to modeling physical systems. On the first approach, simplifying assumptions are made about the level of detail we choose to represent in a computational simulation with an eye toward tractability. On the second approach simpler, analogue physical systems are considered that have more or less well-defined connections to systems of interest that are themselves too difficult to probe experimentally. Our interest here is in the connections between the artifacts of modeling that appear in these two approaches. We begin by outlining an important respect in which the two are essentially dissimilar and then propose a method whereby overcoming that dissimilarity by hand

4B- ECONOMICS

EMPIRICAL VALIDATION OF SIMULATION MODELS IN ECONOMICS: METHODOLOGICAL ISSUES AND OPEN PROBLEMS

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This paper will consider the problem of finding a criterion to empirically assess simulation models as well as to compare and adjudicate competing simulation models. This problem is often regarded as the Achilles' heel of the simulation approach to economics. We first identify some key methodological issues facing, in general, economists engaged in empirical validation of simulation models. We then appraise the extent to which two alternative approaches deal with these issues. The first approach considered is the simulation methodology endorsed by neoclassical economics and, in particular, by the real-business cycle school. The second one is agent-based computational economics.

HOW DO MICROSCOPIC MODELS OF FINANCIAL MARKETS EXPLAIN?

Meinard Kuhlmann

Econophysics is an interdisciplinary subdiscipline between physics and economics that analyses economical phenomena by using methods, models and theories from physics. Econophysics seems to offer reductive explanations since particular observed phenomena are reduced to underlying micro-mechanisms, which account for a number of diverse phenomena. I investigate whether models in econophysics actually give explanations. To this end I analyse one particular representative model and test how well it fits into different theories of explanation. Summing up, my result is that econophysics does not explain in the strict sense of any theory of explanation. However, I demonstrate how theories of explanation could, in a revised and extended form, accommodate econophysics.

results in usefully analogous behavior.

5A- Epistemology of Simulation

Three Theses Regarding the Epistemology of Simulations

Reiss Julian

Simulating many-body systems: the epistemic role of 'cross-model justification'

Axel Gelfert, Collegium Budapest Institute for Advanced Study

On a recent influential view, models in science function as 'mediators' between theory and data. However, in order for the 'mediator view' to be an adequate account of scientific models, it must accommodate an account of mathematically rigorous results. Rigorous results often provide ways of assessing the success of computer simulations of individual models. This is because rigorous results often map different models on to one another. While this may allow for the transfer of warrant across different models, it also puts constraints on the extent to which performance in specific empirical contexts is the touchstone of success in scientific modelling.

5B- Cognitive Science, Psychology and Artificial Intelligence (1)

M-S Model A New Approach to Models and Simulations in Artificial Intelligence

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This paper will examine the role and the principles of models and simulations in artificial intelligence. There will be three main parts: In the first part, I will show the general characteristics of modeling processes in science and engineering. In the second part, I will argue the necessity of considering the principles of simulations and models in AI distinct from the classical notions of simulations and models in science and in engineering. Finally, in the third part, I will propose the M-S model as a new type of modeling strategy peculiar to AI and explain its certain features.

From "psychic machines" to neural networks: Learning from models and computer simulations in psychology

Dirk Schlimm, McGill University

Three examples of the use of models and computer simulations in psychology are discussed: Clark Hull's 'psychic machines,' physical symbol systems, and neural networks. In all three examples the existence of a model was taken to prove the viability of certain hypotheses, which had been claimed to be untenable on a priori grounds. These insights are different from those obtained during construction and through manipulations of models, which have been identified as those phases in which scientists learn from models (Morgan 1999). Moreover, argue that computer simulations in psychology (both classical and connectionist) differ fundamentally from the computer simulations, as they are described, e.g., in (Winsberg 2001) and (Hartmann and Frigg 2005). In particular, with the use of synthetic models new methodological and epistemological issues arise.