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Knowledge Transfer and Its Contexts

10 and 11 September 2015
Center for Advanced Studies at LMU Munich

Abstracts

Seamus Bradley (MCMP): *Modeling Inequality*

(joint work with Karim Thébault and Alexander Reutlinger, MCMP)

Econophysics is a new and exciting cross-disciplinary research field that applies models and modelling techniques from statistical physics to economic systems. It is not, however, without its critics: prominent figures in more mainstream economic theory have criticised some elements of the methodology of econophysics. One of the main lines of criticism concerns the nature of the modelling assumptions and idealisations involved, and a particular target are 'kinetic exchange' approaches used to model the emergence of inequality within the distribution of individual monetary income. This paper will consider such models in detail, and assess the warrant of the criticisms drawing upon the philosophical literature on modelling and idealisation. Our aim is to provide the first steps towards informed mediation of this important and interesting interdisciplinary debate, and our hope is to offer guidance with regard to both the practice of modelling inequality, and the inequality of modelling practice.

Pedro D. Duarte (University of São Paolo): *Travelling Facts and Knowledge in Recent Macroeconomics*

In the history of recent developments in macroeconomics, we find economists emphasizing the force of facts in forging a consensus understanding of business cycle fluctuations. According to this view, rival economists could no longer hold disparate views on the topic because "facts have a way of not going away" (Blanchard 2009). But how can macroeconomists observe the workings of an economy? Essentially through building and manipulating models. Thus I want to examine the conditions under which macroeconomic facts, empirical regularities that come to be widely accepted, traveled across the different models developed recently in mainstream macroeconomics. "Stylizing" macroeconomic facts meant negotiating which aspects of the economy are most relevant and how to measure them. Additionally, macroeconomists attached great weight to facts that are robust with respect to either their definition or to their measurement. So the conditions that allowed facts to travel were intertwined with the process of stylizing and modifying them. Finally, I want to emphasize the context in which facts travelled, opening up technical spaces where macroeconomists negotiated their theoretical commitments and eventually allowing a consensus to emerge.

Catherine Herfeld (MCMP): *How Theories Travel: The Case of 'The Theory of Games and Economic Behavior', 1944-1970*

(joint work with Malte Döhne, MCMP)

How are scientific innovations adopted and how do they spread across scientific communities? In this talk, we address those two questions by analyzing the case of John von Neumann and Oskar Morgenstern's *Theory of Games and Economic Behavior,* taking it as exemplary for a successful scientific innovation. Departing from the observation that the wide adoption of the mathematical concepts and tools contained in the book has increased disproportionally only from the 1970s on, we trace its spread across those disciplines at large. By applying network analysis to co-citation data, we identify a small set of key seminal contributions as having played a crucial role in enabling the spread of game-theoretic concepts across the social and behavioral sciences. One goal of our analysis is to identify the social-structural conditions for a scientific innovation to be successful. Furthermore, we make a case for the fruitfulness of empirical network analysis in the history and philosophy of (social) sciences.

Paul Humphreys (University of Virginia): *How Formal Models Cross Scientific Fields*

I shall contrast the use that Thomas Kuhn made of representational schemas within paradigms with the cross-disciplinary uses of theoretical and computational templates. What is transferred will be clarified: Scientific knowledge can be transferred from one domain to another, mathematical knowledge can be transferred to science, both know-how and knowledge-that can be transferred, as can knowledge of methods and knowledge of representations. I shall argue that some, although by no means all, of knowledge transfer between the sciences can be captured by formal mathematical and computational templates, with empirical content being injected only at the point of application. A central feature of templates is that they are constructed and the construction process allows in some cases consistency with multiple domains. The effects of this on the supposed inseparability of science and mathematics will be discussed as will the consequences for scientific realism. I shall also argue that the extent of disunity across the sciences has been overstated and that what counts as a domain of application is ambiguous. The philosophical points will be illustrated with both historical and contemporary examples.

Jeremiah James (University of Ottawa): *Bottom-Up and Center-to-Periphery? Reassessing Accounts of Knowledge Transfer in the Physical Sciences*

(joint work with Christian Joas, LMU Munich)

The interwar years saw rapid transformations in both theoretical physics and theoretical (physical) chemistry. These are commonly presented as divorced processes, each part of a two step development where the fundaments of new theories were first fully established in physics, specifically through the formulation of quantum mechanics, primarily as a solution to problems in atomic spectroscopy, and then applied to "peripheral" fields of physics and to physical chemistry, giving shape to new sub-disciplines in the process. Recently, historians and philosophers of science have reconsidered who set the terms of this supposed knowledge transfer, and the image of an active colonization by atomic physics has given way somewhat to that of an appropriation by practitioners of neighboring fields with their own research techniques and agenda. However, in itself, this change leaves intact the directionality of the dissemination model—fundaments to applications, atomics spectroscopy to the rest of physics—as well as the timing of the two step process, in which the transfer of knowledge occurs largely after the final formulation of the fundamental theories. Our research on the overarching development of quantum theory, including the broader interests of the researchers who contributed to its formulation, coupled with research into some of the first "frontiers" to be

colonized by the new theory, suggests a less unidirectional, earlier, and more protracted model of the knowledge transfer involved in these interwar developments. It also suggests that the disciplinary transfer and the geographical transfer of key components of these innovations were intertwined.

Tarja Knuuttila (University of South Carolina): *Synthetic Biology: Turning Biology into an Engineering Discipline?*

Contemporary biology labs have become highly interdisciplinary places: the earlier wet lab, the realm of biologists, has been combined with the dry lab, through which computational scientists, engineers and physicists have entered biology. One of the latest developments within biological sciences that perhaps most radically exhibits this highly interdisciplinary dimension of biology is synthetic biology. It is often understood in terms of the pursuit for well-characterized biological parts to create synthetic wholes. As a result synthetic biology has been criticized for its being too engineering dominated field. Yet the relationship of synthetic biology to engineering involves a sophisticated epistemic dimension, which is most clearly displayed by the practice of synthetic modeling. Synthetic models are engineered genetic networks that, after their construction, are implanted in cells in order to study gene regulation in its natural environment. From the perspective of knowledge transfer, what is especially interesting about synthetic models is, firstly, the way their construction draws upon various disciplines such as physics and chemistry, engineering functioning merely as an umbrella for the diversity of influences. Secondly, the construction of synthetic models draws heavily on mathematical modeling and simulation. This close combination of mathematical and synthetic modeling has questioned some central assumptions and notions on which synthetic biology has been based. As a result synthetic biology has become more "biology inspired" addressing such questions as the modularity of biological systems and the role of noise in biological organisms.

Sabina Leonelli (University of Exeter): *On the Movements and Value of Scientific Data*

This paper reports on an ongoing effort to study the movement of scientific data from their production site to many other sites of use within or beyond the same discipline, from both an empirical and a philosophical standpoint. Empirically, the study is grounded on the reconstruction of specific data journeys across four research areas: plant biology, model organism biology, biomedicine and oceanography. Philosophically, the study aims to analyse the conditions under which data travel across what I call, following John Dewey, "research situations," and what implications this has for the epistemology of science. I focus in particular on online databases as infrastructures set up to facilitate data dissemination and their multiple re-interpretations as evidence for a variety of claims across different settings; and on the wealth and diversity of expertise, resources and conceptual scaffolding used by database curators and users to expand the evidential value of data thus propagated. Through the reconstruction and careful analysis of data journeys, a great deal can be learnt about the multiple roles and valences of data within research, ranging from their essential function as evidence to their importance as currency in trading, tokens of identity and means to foster the legitimacy, accountability and value of scientific research within a variety of contexts. These insights inform a philosophical analysis of knowledge production that is attentive to the processual, dynamic nature of research, as well as its embedding in social, political and economic settings that have a strong bearing on what comes to be viewed as scientific data, by whom, and why.

Chiara Lisciandra (TINT Helsinki): *Norms in Economics and Psychology*

Norm compliance is a field of study that has received contributions from a variety of different disciplines. Yet the level of conceptual exchange between different parties is disputed in the literature. On the one hand, economic models of socio-normative behaviours are often presented as psychologically informed models of individual decision-making. On the other hand, they have often been criticized for being simply more elaborated `as if' economic models. The question thus arises of the nature of the interaction between psychology and economics. Is the study of social norms a case of successful interaction between economics and psychology? What exactly has been exchanged between these two disciplines? Have psychologists and economists collaborated in the development of this research area? To answer these and related questions this paper will pursue a path, which has been so far unexplored in the literature, which consists in looking at the scientific literature - i.e. articles, book reviews and conference proceedings - to discover whether and to what extent this research area has been shaped by interaction between economists and psychologists. The evidence will be a bibliographic dataset, created from the Web of Science platform that will trace authors' collaboration and their respective affiliations. The work will apply a novel methodology to answer the question whether the study of social norms has benefited from interaction between different fields of study. The results of the inquiry will have the potential to be combined with a more traditional philosophical analysis on concepts transfer between disciplines.

Sebastian Lutz (MCMP): *Choosing How Far Concepts Travel*

I argue that a descriptive theory of reference and meaning is needed for engaging in productive empirical research, which raises again the question of the analytic and synthetic component of theories. I provide a compact reformulation of Rudolf Carnap's conditions of adequacy for the analytic and the synthetic component of a theory and argue that the Carnap sentence should not be considered the only possible adequate analytic component. The Carnap sentence rather formalizes an extreme notion of incommensurability between concepts of different and especially competing theories. Other analytic components are possible, and these allow surprisingly fine control over which theories can share concepts.

Uskali Mäki (TINT Helsinki): *Scientific Imperialism. Definitional and Normative Issues*

The paper first looks at the concept of scientific imperialism by reflecting on its two components, 'scientific' and 'imperialism'; puts the interdisciplinary version of scientific imperialism on a larger map of versions; outlines a framework for identifying its various aspects; and ponders issues of normative assessment. It then proceeds through two sets of questions. First, considering that interdisciplinary transfer / travel / trespassing happens all the time throughout science, what distinguishes imperialistic from non-imperialistic trespassing? My preference is to draw a vague line that is normatively neutral. Second, do normative standards of epistemic performance depend on whether trespassing occurs or not; and whether it is imperialistic trespassing or not? This divides into two further issues: a. The epistemic pursuits and alleged epistemic achievements of imperialistic science often look similar to those of non-imperialistic science (e.g. expansion, unification, novelty); should they be assessed differently, even in terms of different standards? b. The alleged failures in the epistemic (and perhaps other) pursuits of imperialistic science often look similar to those of non-imperialistic science (e.g. explanatory failure, crowding out of other lines of research); should they be assessed differently, even in terms of different standards? In answering such questions, I am generally attracted by the idea that imperialist science is to be judged by the same standards that we apply to all science, together with the generally advisable proviso that the standards and their application are often to be adjusted so as to be responsive to the peculiar characteristics of each specific type of case.

Robert Meunier (University of Kassel): *From Organ to Tumour Development, from Animal to Patient: Modelling Human Cancer in Zebrafish*

In my contribution I will analyse modelling strategies in contemporary molecular oncology based on Zebrafish as a model animal. Zebrafish has been introduced as a laboratory animal in the 1970s, mainly in the context of developmental and neuro-physiological genetics. Being part of the small group of genetically and genomically well characterized model organisms, since the last 10 years it has become increasingly employed in research on human diseases, and in particular in the study of tumour development and the search for cancer drugs. This case poses the question of knowledge transfer in two interesting ways. The first concerns the relation of developmental and cancer biology. Due to changes in funding policies, many researchers working with Zebrafish in developmental biology turned to cancer biology. While cancer was seen as a developmental disease for a long time, this led to an increased transfer of methods and approaches from the study of organ development to the study of tumour development. The second question concerns the translation of results achieved in model organism based research to human patients. In this respect I will argue that model organisms do not represent humans in a straightforward manner, but rather should be seen as elements of model systems that relate in various ways to experimental and observational systems that involve patients or human material. Model systems are built based on data gained in such experimental or observational systems, contain material derived from them, or produce material or data that can feed back into the human subject or material based systems, or can inform the strategies in these systems in terms of relevant questions or applicable protocols.

Klaus Schmidt (LMU Munich): *How did Psychology affect Behavioral Economics?*

Behavioral economics is a young field in economics that tries to incorporate psychological insights into economics. It thereby departs form standard neoclassical economics that is based on the assumption that all economic agents are perfectly rational and purely self-interested. I first explain why the neoclassical model - despite its many shortcomings - is still the dominant paradigm in economics and why it serves as an important benchmark even in behavioral economics. Then I show that behavioral economics was successful in challenging neoclassical economics only after introducing modifications to the psychological methodology of decision experiments. I argue that psychology has been most influential when it took the neoclassical model seriously. The prime example for this is the work of Daniel Kahneman and Amos Tversky on prospect theory. Finally, I show that behavioral economics and economic psychology are still very different from each other with limited interaction between economists and psychologists. In particular, behavioral economic theory is still based on the fundamental principles of “optimization” and “equilibrium” both of which play hardly any role in psychology.

Sabine Thürmel (Munich Center of Technology in Society, TU Munich): *Learning from the Best: Agent-based Approaches in Science and Engineering*

Since the early 1990s computational science and engineering approaches have profited from agent-based models (ABM) and multi-agent systems (MAS) in general. ABM and MAS focus on the simulation of complex interactions and relationships of human and/or non-human agents. Agent-based simulators are well-established tools for gaining insights into the dynamics of complex systems and for experimenting with behavioral variants. Abstraction and idealization guide the discovery process. Due to the nondeterministic nature of agent-based systems one must proceed with great care when in trying to transfer the insights gained in the laboratory to real world scenarios. Thus, in these cases “learning from the best” refers to well-conceived in-silico experiments serving as role models. For natural scientists and scholars in the humanities agent-based simulators are just a tool. However, in engineering agent-based approaches “aid

intuition". The overall goal is to learn from well-tested coordination strategies found in nature and human societies to develop distributed problem solutions. Agent-based systems are especially helpful (1) if the information and expertise is distributed in space and time, (2) if the relationships among the technical entities may be dynamically changed, and (3) if new organizational structures may arise and change over time. In engineering agent-based systems "learning from the best" means adapting bionic or societal models to technical problems.

Roel Visser (Erasmus Institute for Philosophy and Economics): *Expert Knowledge as Mediator between Uncertainty Measurement and Policy*

How certain are macroeconomic forecasts? To answer this question, both the econometric forecasting literature and the more philosophical measurement literature advocate the use of expert knowledge. Although the potential value of adjusting forecasts using expert knowledge has been theoretically proven, little is known on how it is used in practice. Is there a top-down transfer of knowledge from the theoretical literature to practical research contexts, or is the interaction more dynamic? To investigate this I studied the CPB Netherlands Bureau for Economic Policy Analysis, which uses expert knowledge to mediate between the relevant scientific literatures and policy applications. This research is based on an internship at the CPB and interviews with several stakeholders. My analysis reveals that the CPB is quite hesitant about the use of expert knowledge. This hesitance is firstly caused by the practical constraints of the policy applications for which macroeconomic forecasts are used. Secondly, the use of subjective expertise does not fit well with the demand for objective policy advice that the CPB has to meet. Consequently, the use of expert knowledge is about more than the quantitative improvements it makes to macroeconomic forecasts through manual adjustments. It also concerns the methodological considerations that influence the choice among different forecasting methods. This role of expert knowledge is often overlooked due to its localized and subjective nature. I therefore argue that the use of expert knowledge in practice can only be fully understood if there is an additional knowledge transfer from experts back to the theoretical literature.

The workshop is co-sponsored by:

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Deutsche
Forschungsgemeinschaft