Philosophy of Interdisciplinarity: A Manifesto

Uskali Mäki

This is a call for systematic collective attention to the philosophical issues of interdisciplinarity in science, so as to supplement other perspectives such as sociology, education, administration, and scientometrics. Outlines are sketched for what a philosophy of interdisciplinarity could be and do, why the time is ripe for philosophy of science to make major advances in the study of interdisciplinarity, and why this will be a fruitful step to take for philosophy of science more broadly. Some doubts about whether this is a viable idea are discussed.

Model exchanges and their interdisciplinary success

Till Grüne-Yanoff

Interdisciplinarity is an ideal: a teleological concept with normative assessment criteria. The current mainstream claims that a necessary criterion for interdisciplinary success is the integration of disciplines, and that this is an end in itself. In this paper, I argue to the contrary that integration of disciplines, concepts or methods is not a necessary condition for interdisciplinary success. I discuss two cases of interdisciplinary model exchange – between biology and economics, and between psychology and economics, respectively – which exhibited successful interdisciplinary interaction, but which did not lead to integration of disciplines, concepts or methods. In particular, these interdisciplinary exchange episodes had important epistemic effects on the respective disciplines, so that one can justifiably speak about success, but these effects led the respective disciplines into different directions, so that one cannot justifiably speak about integration. The conclusion that integration is not a necessary condition of interdisciplinary success is relevant for current science policy, which seems to be overly dominated by the current integrationist mainstream view.

Neuroeconomics as triangulation
Jaakko Kuorikoski and Caterina Marchionni

Neuroeconomics is one of the most discussed interdisciplinary fields in social science today but questions remain as to its relevance to economics. In this paper we examine Woodward's proposal to understand neuroeconomics experiments in terms of triangulation of evidence by independent means of determination. For neuroeconomics evidence to be used for successful triangulation, two main requirements ought to be satisfied: that neuroeconomics evidence is independent of other kinds of evidence and that it is comparable to evidence obtained by other means. We argue that many neuroeconomics experiments are not suitably independent with respect to behavioral experiments and are liable to provide evidence for what is in effect an artifact of the game-theoretically defined behavioral experiments, rather than to the intended general psychological disposition with external validity. We also show that when triangulation functions to control for errors and biases of causal inferences from data to phenomena comparability is not a problem. We illustrate our claims by analyzing some prominent neuroeconomics experiments, mainly in the context of the debate on social preferences. Our analysis also addresses some of the criticisms leveled against the very idea of triangulation.

Interdisciplinarity at the grassroots level: The modeling practice of synthetic biology
Tarja Knuuttila and Andrea Loettgers

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. We discuss the combinational modeling practice in the emerging field of synthetic biology. With combinational modeling we refer to the process whereby experiments on model organisms and mathematical models/simulations are combined with synthetic models (i.e. engineered genetic networks that are implanted in a natural cell environment). One reason for this practice is, we argue, the epistemic uncertainty caused by applying to biology the tools and concepts taken from physics and engineering.

Transdisciplinary problem-solving: Emerging modes in integrative systems biology

Miles MacLeod

Integrative systems biology is a relatively new field of computational biology that attempts to integrate computation, engineering concepts and methods, and molecular biological data and theory in order to model large scale complex biochemical networks. Handling these complex integrative problem-solving tasks necessitates a distinctly transdisciplinary form of problem-solving that we call adaptive problem solving. I'll endeavor to outline the nature of this problem-solving through the agency of an ethnographic study of two systems biology labs. The transdisciplinary nature of these tasks takes the form of a requirement that modelers and experimenters be capable of stepping-out of their disciplinary backgrounds, and becoming experts in other disciplines in order to adapt concepts and methods from these disciplines to their particular problems. The choice of disciplinary approaches and methods available generates a large space of methodological alternatives for researchers to explore. I'll suggest that in fact it is the project of attempting to apply systems theory to biochemical systems, and interpret it with respect to these systems, that necessitates transdisciplinary problem-solving. Systems theory principles seem to require non-disciplinary structures and interactions in order to be implemented, at least in the context of current disciplinary biology.

On the kinds and roles of non-academic knowledges in transdisciplinarity

Inkeri Koskinen and Uskali Mäki

Transdisciplinary research has become common in the study of such multifaceted problems as biodiversity loss, climate change and poverty, but also for example in the development of new, usable technologies. Nevertheless, the concept of transdisciplinarity denotes a tremendously heterogenous set of phenomena, many of which combine contributions from both academic and non-academic agents. We suggest that the different kinds and roles of non-academic knowledges in transdisciplinarity partly induce this heterogeneity. Non-academic participants in transdisciplinary projects include for example industries, indigenous peoples, patient associations and artists, and their knowledge can be understood as consisting of bits and pieces of locally relevant information – or whole knowledge systems with their own, distinctive epistemologies. Also the role given to non-academic knowledge in transdisciplinary projects varies greatly, and so do the kinds and degrees of integration of different kinds of knowledges. The way in which non-academic knowledge is understood, and the role it is given, have consequences for the hard issue of normative assessment of transdisciplinary projects.