

## **New Trends in Metaphysics of Science, Paris, 16-18 december 2015**

### **Abstracts**

**Michael Esfeld**

#### **Reanimating natural philosophy**

The paper is a plea for natural philosophy as it is practiced at the time of Descartes, Leibniz and Newton, treating physics and metaphysics as being inseparable in the quest for a theory of nature. I will present a proposal for a fundamental ontology in terms of matter points that are individuated by the spatial relations in which they stand and the change in these relations. The dynamical structure of a physical theory with its various dynamical parameters (mass, charge, wave function, etc.) then comes in as our means to capture that change in an efficient manner. The argument for this proposal is that on the one hand, it is a most simple and most general ontology, while on the other hand, it is rich enough to explain the experimental evidence. I will in particular sketch out how this proposal covers both classical and quantum mechanics.

**Steven French**

#### **Between Humeanism and Dispositionalism; or, How to Construct a Modal Framework for Modern Science by Appropriating Metaphysical Devices**

What role should so-called 'analytic' metaphysics play in the construction of a naturalistic metaphysics of science? None, some might say, dismissing current analytic metaphysics as so out of touch with modern science as to be unworthy of consideration. This raises the obvious questions, on what basis is such construction to proceed and with what tools? In contrast, McKenzie and I have argued that although there are grounds for this dismissal in certain cases, we may yet appropriate various devices from the metaphysicians' own toolbox and deploy them for our particular ends.

As an example, I shall recall the grounds for thinking that Dispositionalism is not 'fit for purpose' when it comes to a metaphysics of science. That should not be taken as giving comfort to the Humean, since that view is also subject to well-known difficulties, exacerbated by modern physics. Nevertheless, there are other devices that one may deploy in order to construct an appropriate modal metaphysics and here I shall sketch some that I consider to be potentially fruitful in this regard.

However, these devices are such that the details need to be 'fleshed out' by the relevant physics, leading to the worry that this appropriation yields less a form of naturalism and more a kind of eliminativism. I shall conclude by reflecting on this worry and arguing that first, this is perhaps the best that naturalistically inclined metaphysicians can hope for and secondly, that it can still be presented as a collaboration between physics and metaphysics in the construction of a metaphysics of science.

**Max Kistler**

#### **How Physics Informs us about Causation**

There are two ways of denying that causation is a significant concept in the context of a physical description of the world: by denying that physical descriptions of reality contain anything that can be identified with causes and effects or by claiming that all functional dependencies identified by physics are causal. I argue that the concept of causation expresses category of relations and processes that is neither empty nor

tautological. Physics contributes in two ways to shape this concept whose origin is in common sense: 1) special relativity contains a necessary condition for two events to be causally related and 2) the concept of a conserved quantity can be used in a philosophical hypothesis about a sufficient condition for two events to be causally related. Transmission of amounts of conserved quantities might be what physics suggests fills the conceptual role of causation.

**Matteo Morganti**  
**Science and the Metaphysics of Grounding**

The notion of grounding, i.e., the idea that the structure of reality is usefully accounted for in terms of ontological priority/dependence and non-causal 'in virtue of' relations, is swiftly gaining popularity among metaphysicians. The aim of this paper is to illustrate the relevance of grounding for the philosophical analysis of science. After having introduced the key conceptual elements of the theory (theories) of grounding, the usefulness and relevance of the latter for the metaphysics of science will be argued for in two ways: first, by showing that, contrary to widespread belief, it allows one to go beyond entrenched atomistic and mereological presuppositions that may indeed have to be – at least partly – overcome if metaphysics is to be 'empirically adequate'; secondly, by providing examples of the way in which specific models of grounding afford a better understanding of certain aspects of contemporary science, especially physics.

**Alyssa Ney**  
**Finding the World in the Wave Function: Some Strategies for Solving the Macro-Object Problem**

Realists wanting to capture the facts of quantum entanglement in a metaphysical interpretation find themselves faced with several options: to grant some species of fundamental nonseparability, adopt holism, or (more radically) to view localized space-time systems as ultimately reducible to a higher-dimensional entity, the quantum state or wave function. Those adopting the latter approach and hoping to view the macroscopic world as grounded in the quantum wave function face the macro-object problem. The challenge is to articulate the metaphysical relation obtaining between three-dimensional macro-objects and the wave function so that the latter may be seen in some sense as constituting the former. This paper distinguishes several strategies for doing so and defends one based on a notion of partial instantiation.

**Anya Plutynski**  
**Cancer Causation, Explanation and the Metaphysical Commitments of Theory**

Mathematical models of cancer's dynamics and mechanistic characterizations of the role of specific mutations or pathways in generating the distinctive features of cancer cells treat cancer causation at very different levels of abstraction. There have been several more or less successful attempts to synthesize the micro- and macro- scale, with "systems" approaches to cancer. Why has this proven so difficult? How exactly do (or should) these theories and explanations of cancer relate to one another? Are these different scales of analysis cases of levels of mechanism, levels of realization, or perhaps

cases of potential reduction? In this talk I offer an a general account of how several examples of explanations of cancer are interrelated, drawing in part on Woodward's account of causation and causal explanation, and in part on Craver's account of levels of realization and mechanism. In my view, there are two directions of constraint on adequate explanations; one comes from the target explananda, and another from the known mechanisms (in the sense of composition). But there is a great deal of "give" between our models and mechanistic understanding. Whether we should view this as a problem depends, in my view, on what we want our models to do for us. I also consider why attempts at "systems" biology of cancer have proven so challenging. I will make some effort toward addressing more generally how this matters or should matter to cancer scientists; there are genuine debates about how to do "integrative" cancer research among cancer scientists, and thus there is an opportunity here for philosophers of science to at least clarify the terms of the debate.

**Laura Ruetsche**

### **Effective Theories, Ineffective Interpretations, and Naturalistic Metaphysics**

Some have argued (fiercely!) that metaphysics is naturalist or it is nothing. Let us follow David Wallace in understanding "Naturalism" here as "the thesis that we have no better guide to metaphysics than the successful practice of science" (2012, 58). But how good a guide is it? Not very good at all, I'll try to suggest. The suggestion will rest on three features inherent in the successful practice of our best current physical theories. These features interfere with our sustained and sincere attempts to articulate an unambiguous "metaphysics of modern science." Two of these features are varieties of underdetermination largely underappreciated in the satellite-level debate over scientific realism. The third is the prevalence of effective theories.

**Stéphanie Ruphy**

### **Pluralist challenges to a science-based metaphysics**

A widespread motivation for a *science-based* metaphysics is the idea that since metaphysics aims at getting objective truths and since science is precisely in the business of providing objective knowledge about the world, metaphysics should be very close to science, in one way or another. But is science really in the business of providing the kind of *objective* knowledge that metaphysicians value and aim for, that is, knowledge about 'the ultimate structure of reality' or about 'how the world *really* is'?

A naturalized approach (dear to proponents of a science-based metaphysics) to this question recommends looking at the actual state of science, and a commonly acknowledged feature of this state today is its disunity. Indeed, while the philosophy of science has for a significant part of its professionalized existence waved the (motley) banner of the unity of science, few would deny today that the philosophical tide has clearly turned in favour of the plurality of science.

My aim in this talk is to investigate which parts of the multifaceted project of a science-based metaphysics should be revised or even dropped in light of scientific pluralism. I will investigate in particular what is left of ontological objectivity in a pluralist, model-based view of science, when scientific knowledge is taken as inherently perspectival (e.g. Giere 2006) and when science can only provide us with a collection of idealized ontologies (e.g. Teller 2004). I will suggest at the end that a valuable aim of a science-based metaphysics is not so much to get at 'objective truths about the world' (a lost

cause given the perspectival nature of scientific knowledge) than to grasp, in a Neo-Kantian (or Friedmanian) vein, the structures and external constraints of our modes of production of scientific knowledge and objectivity.

**Markus Schrenk**

### **A History of Production and Modality**

Hume held that “efficacy, agency, power, force, energy, necessity, connexion, and productive quality, are [...] nearly synonymous.” (Hume 1739: 157) Indeed, the transition from each member of the following cascade of statements to the next is fairly intuitive: “c produces e”, “c brings about that e”, “c causes e”, “c necessitates e”, “it is necessary that when c then e”.

I am interested in the relation between the two endpoints, production and modality. I will give a couple of historical examples where they have been treated as if they were the same thing or, at least, where they have not been explicitly distinguished.

My examples come from the reductive analysis of dispositional predicates, but also from its opposite, dispositionalism, from causation and from laws of nature.

The goal is to highlight differences which might indicate that we should not identify the two at all.

**William C. Wimsatt**

### **Biological Design Elements in the Architecture of Nature**

Metaphysicians tend to look at the then current elementary particles and their relations as a basis for constructing a scientific metaphysics. I look at the organization of composite systems, which comprises everything made from them as a source of important architectural principles. These principles are reflected over and over again in diverse kinds of systems, and thus deserve a deep, even metaphysical status. These principles include ***generative entrenchment***, the tendency for constructions to proceed hierarchically, with deeper elements anchored selectively by their role in generating more derivative ones. ***Heuristics*** and adaptations are shown to have a common logic as products of their roles in ***scaffolding*** goal-attainment in complex systems. Selection incorporates anything that works well enough often enough. Thus ***selectable patterns of organization*** are to be characterized stochastically, producing ***mechanisms*** and ***sloppy gappy generalizations*** that would not meet the constraints of traditional law-formulations. Things that are sufficiently important should show increasing reliability thru redundancy, secured often thru multiple diverse means. This principle also applies ***to robust inference***, and provides an important kind of local realism widely used by scientists, which confers reality on things at higher as well as lower ***levels of organization***.

**James Woodward**

### **Physical Modality, Grounds, and Invariance**

Physical modality and related notions (“law”, “cause” etc.) seem philosophically puzzling in part because (we think) it is unclear how to “locate” them—unclear, what if

anything in the world “corresponds” to them or “makes them true” or “grounds” them. On the one hand, “objectivist” treatments that involve the postulation of special metaphysical entities and relationships (“relations between universals”, “powers and dispositions” and other “non-Humean stuff”) are (in my opinion) unexplanatory and arguably reflect a misguided impulse toward a kind of reification of modality, akin to Whitehead’s “fallacy of misplaced concreteness”. On the other hand, more “subjectivist” or “Humean” alternatives that attempt to understand physical modality in terms of our tendency to “project” our patterns of thought and epistemic organizing activities onto nature seem to fail to do justice to scientific practice. This talk will explore whether there is a middle way between these two alternatives. Drawing on some well-known remarks of Eugene Wigner’s, I will sketch an account of laws of nature in which notions like invariance and various independence conditions play a central role and which seems to me more promising than either of the alternatives sketched above. I will then use this account to explore some more general issues having to do with just what might be involved in providing truth conditions or grounds for modal claims – what, on a naturalistic view of the world, these might consist in and what work they might connect to the project of understanding the role played by modal notions in our thinking. The idea that facts about nature can provide an “objective” support or basis for modal thinking without containing special metaphysical entities that serve as “correspondents” for modal claims will be emphasized.