Workshop Explanation, Causality and Unification

Abstracts

Michael Baumgartner (Konstanz): *The Causal Chain Problem*

Abstract: This talk addresses a problem that arises when it comes to inferring deterministic causal chains from pertinent empirical data. It will be shown that to every deterministic chain there exists an empirically equivalent common cause structure. Accordingly, our overall conviction that deterministic chains are one of the most ubiquitous (macroscopic) causal structures is underdetermined by empirical data. The question arises thus why ever so many processes in nature are nonetheless unequivocally modeled in a chain-like manner. In the second part of the talk, I investigate possible answers to that question.

Lorenzo Casini (Kent): *Causality in Computational Economics: An Inferentialist Proposal*

Abstract: How should we interpret causal claims in computational economics? Here I focus on two models of asset pricing (Lux and Marchesi 1999, 2000; Arthur et al. 1997 and Le Baron et al. 1999). Consider the effects of asset pricing mechanisms, more evidently, bubbles and crashes. Bubbles and crashes, as well as their statistical features, are the result of many agents buying or selling depending on their information and computing tools. Contra neoclassical economics, the models show that the pricing mechanism is such that bubbles and crashes may well be due not to exogenous factors (e.g., a new bit of information) but to structural properties of the system (e.g., number and distribution of traders, rate of change in the traders' attitude and/or trading strategies). Such properties result in causal relations which are hard to account for by means of traditional theories of causality. I put forward an inferentialist interpretation of causal claims, which draws on the semantic views of Sellars (1953, 1962) and Brandom (2000, 2007).

Alexander Gebharter (Düsseldorf): *Applications of Causality Theory: Mechanisms and Causal Cycles*

Abstract: Mechanisms are typically characterized as systems consisting of several parts so that the interactions between these parts regularly produce a specific phenomenon (cf. Glennan, 1996). Given a characterization like this one, mechanisms can be used to explain/predict concrete phenomena in specific space-time regions. The term 'interaction' indicates that mechanisms are causal systems themselves and should thus be analyzable within the framework of any general theory of causality, such as one based on causal graph theory as it was developed by researchers like Pearl (2009) and Spirtes *et al.* (2000). In this talk I will present some problems raised by such attempts and give some ideas of how they can probably be dealt with.

Victor Gijsbers (Leiden): *Unification and Causation: Two Different Kinds of Understanding*

Abstract: I will argue that there are two different types of understanding: the understanding we get from explanations, and the understanding we get from successful classification. First, I will discuss several proposals for understanding without explanation made by Peter Lipton, Dennis Dieks en Henk de Regt. What is common to these proposals is the idea that we can understand through non-explanatory classification. But not every classification gives us understanding. Using Gerhard Schurz's theory of unification, I will claim that a necessary condition for successful classification is that it unifies our knowledge; and I will suggest that on a certain reading of Schurz's theory, the condition might even be sufficient.

Andreas Hüttemann (Cologne):

Abstract: No abstract available.

Kevin Kelly (Pittsburgh): *Simplicity and its Connection with Empirical Truth*

Abstract: Scientists prefer simpler theories and invoke Ockham's razor as their justification. But what is simplicity and what connects it with empirical truth? Standard accounts of Okham's razor either sidestep the question by substituting an alternative aim for science or beg it by assuming that the world is simple or probably simple. I will present a new, topological theory of empirical simplicity and an argument that, in light of that theory, Ockham's razor is as close as an inductive truth-finder can come to deduction. The presentation will be self-contained. It is aimed at a mixed audience from philosophy, statistics, machine learning, and the sciences.

Theo Kuipers (Groningen): *Nomic Possibility as the Core Primitive Term for a Constructive Realist Explication of Laws and Causal Notions**

Abstract: The supposition of an unknown subset of 'nomic possibilities' within the set of conceptual possibilities generated by an interpreted language and a domain has shown to be very helpful in the structuralist, but realist, explication of the notion of truthlikeness and related logical and epistemological notions (Kuipers, 2000). In a similar way I submit that nomic possibilities, taken as primitive, can be helpful in the realist explication of laws and law related notions, notably causal notions such as causal laws, causal theories and two related types of causal explanation, viz. explanation by subsumption under a causal law or theory and explanation by causal specification. This talk will be restricted to the indication of the explication of laws in general and causal laws in particular. The starting point is an interpreted language for a given domain, generating the set of conceptual possibilities of the language, and within that set an unknown subset of physical or, more generally, nomic possibilities of the domain. A nomic (general) hypothesis claims that a certain well-defined subset of conceptual possibilities is a superset of the set of nomic possibilities, hence, that all nomic possibilities belong to that set (and hence that all conceptual possibilities outside this superset are nomic impossibilities). If this claim is true, the hypothesis is called a (nomic) law. Hence, a law does not determine what is nomically impossible, but the other way around; the nomic (im)possibilities determine what the laws are. If the law claim is held to be true it is called an 'accepted law'. A law is called an 'observational law' when all descriptive terms used in it are previously understood, or observational, or non-theoretical in the sense that they are not laden with the law (claim) itself, but they may well be laden with background theories. Empiricist philosophers of science as Hempel and Nagel have tried to give empiricist criteria for when an observational law is a causal law, roughly, a universal generalization in observational terms of conditional nature of which the 'initial conditions' in the antecedence (the 'causal factors', together constituting the 'cause-event') are space-time contiguous with the (effect-)event reported in the conclusion and which precede it in time. Moreover, there is asymmetry, the cause- and effect-event cannot interchange their role. Finally, the empiricists have much discussed the addition of a counterfactual or some other nomic connotation. Here we will do so without hesitation in the particular way suggested above, our point of departure is: an (observational) causal law is an observational law in the nomic sense that satisfies in addition an updated set of logico-empirical conditions of adequacy for causal lawhood. Of course, an 'accepted causal law' is a causal law claim that is accepted as true. A typical example is "gases expand when heated" or in its explicit causal phrasing: "heating causes the expansion of gases".

* The first part, on laws in general, was also presented at the "Causality and Explanation in the Sciences" conference in Ghent last September. The talk in Düsseldorf will be an extended version that has moreover profited a lot from some talks in Ghent.

Margaret Morrison (Toronto): *Beyond Reduction: Unification and Universal Physics*

Abstract: No abstract available.

Stathis Psillos (Athens): *Regularities All the Way Down*

Abstract: The neo-Humean approach to laws advocates a sparse metaphysical view of the world, according to which there are irreducible regularities in nature (regularities all the way down, so to speak) which involve patterns of dependence among members of natural classes (natural properties) and which underpin the causal and generally modal relations there are between them. Hence, there is no need for an additional law-making property of a distinct metaphysical type—a regularity enforcer. In this paper, I will develop the sparse metaphysics of the regularity view by articulating the view that regularities are mereological sums of their instances (parts).

Henk de Regt (Amsterdam): *Causalism and Unificationism Reconciled*

Abstract: In his later years Wesley Salmon believed that his causal-mechanical model of scientific explanation and the rivalunificationist model are reconcilable. Salmon envisaged a “new consensus” about explanation: he suggested that the two models represent two “complementary” types of explanation, which may “peacefully coexist” because they illuminate different aspects of scientific understanding. In my paper I will present a critical analysis of Salmon’s 'complementarity thesis'. I will conclude that it fails and that we need a more radically pluralist approach to scientific understanding, which allows for a wide variety of explanatory strategies, including causal analysis and unification.

Gerhard Schurz (Düsseldorf): *Causality as an Empirically Significant Theoretical Concept*

Abstract: That regular connections between events are produced by cause-effect relations is one of the most deep-seated intuitions of human minds. Is the concept of causality a cognitive illusion without empirical content/scientific value, or does it have a cognitively and empirically valuable function?

In my view, existing approaches to causality have been too much be concerned with attemtps to provide definitions of causality. In my talk I will argue that causality should be understood as a theoretical concept, in analogy with “force” in Newtonian physics. The only difference is that “causality” does not belong to a particular scientific discipline, but to a “transdisciplinary theory”.

It is the central thesis of my talk that cause-effect relations explain and/or predict certain (in)stability properties of probabilistic dependencies, namely screening off and linking-up. They are the best (available) explanations of these properties. Moreover, they do not merely ex-post explain them, but yield unified explanations of them, have empirical consequences by which they are independently testable and generate novel predictions. In the final part I will develop the theory of causality and demonstrate that an enriched version of it has empirical content, i.e., it excludes certain logically possible probability distributions.

Matti Sintonen (Helsinki): *Pluralism Rules, OK?*

Abstract: No abstract available.

Erik Weber (Ghent): *The Role of Unification in Mechanistic Explanation of Laws*

Abstract: In the literature on scientific explanation, there is a classical distinction between explanations of facts and explanations of laws. This paper is about explanations of laws, more specifically mechanistic explanations of laws. Our first aim is to investigate how mechanistic explanations of laws can be unificatory. If – after mechanistically explaining a law – we have the impression that the world is more unified, where does that impression come from? In order to answer these questions, we distinguish between two types of unification: analogical unification and theoretical unification. These types are compared in with respect to their structure and function.

Jon Williamson (Kent): *How Can Causal Explanations Explain?*

Abstract: According to mechanistic philosophy of science, we explain a phenomenon by pointing to the mechanism responsible for it. This seems to offer a good account of most scientific explanations, which do indeed tend to depend heavily on accounts of underlying mechanisms. On the other hand, a causal account of explanation is also often advocated: according to this account, we explain an event by pointing to the chains of causes that led up to it.

This paper asks how, if the mechanistic account is essentially correct, causal explanations can be genuinely explanatory. It is argued that causal claims only explain to the extent that they trace physical mechanisms. Here mechanisms are understood broadly to include not only the fixed hierarchical structures of components interacting in such a way as to regularly produce some phenomenon (c.f., Machamer, Darden and Craver and others) but also the low-level physical processes of Salmon, Dowe and others. This view has it then that causal explanation, to the extent that it is successful, is just a kind of mechanistic explanation, but a broader kind than typically envisaged by the recent literature on mechanisms.

For causal explanation to work, then, causal relationships must be connected intimately with mechanisms. However, only some accounts of causality posit such a close connection: mechanistic accounts, pluralistic accounts, and certain inferentialist accounts such as the epistemic theory. These accounts are evaluated to see which copes best with explanation in the sciences.