Causality and Explanation in the Sciences

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ABSTRACT: Editors' introduction to the special issue on the *Causality and Explanation in the Sciences* conference, held at the University of Ghent in September 2011.

Keywords: causality; explanation; sciences.

RESUMEN: Presentación del número monográfico sobre el congreso *Causality and Explanation in the Sciences*, celebrado en la Universidad de Gante en septiembre de 2011.

Palabras clave: causalidad; explicación; ciencias.

Causality and causal inference play a central role in the sciences. Explanation is one of the central goals of scientific research. And scientific explanation requires causal knowledge. At least, these are well-known tenets in present-day philosophy of science.

In September 2011, philosophers of science, logicians, mathematicians, biologists, social scientists, computer scientists and the like gathered at Ghent University to discuss the relation between causality and explanation: *Causality and Explanation in the Sciences* (CaEitS2011).[1] In the course of three days, a range of topics were discussed. Different accounts of causality and explanation, such as Jim Woodward's interventionist account, Michael Strevens' kairetic account, and the mechanistic account. The relation between causality, explanation and understanding. The nature and status of causality and explanation in biology, in the social sciences, in medicine, in physics and in mathematics. The relation between causal and constitutive explanation. How causal relations can be discovered and what we can infer from our causal knowledge. Etc.

Causality and Explanation in the Sciences was the sixth episode in the *Causality in the Sciences* series of conferences which originated at the University of Kent.[2] Other conferences focussed on causality and probability in the sciences, on mechanisms and causality in the sciences, or on causality in the biomedical and the social sciences. In September 2012, the University of Kent will host the seventh episode: *Evidence and Causality in the Sciences* (ECitS2012).

Papers presented at the previous CitS conferences have resulted in interesting publications. So far, two book volumes have appeared: Federica Russo & Jon Williamson (eds.), *Causality and Probability in the Sciences* (London: College Publications, 2007), and Phyllis McKay Illari, Federica Russo & Jon Williamson (eds.), *Causation in the Sciences* (Oxford: Oxford University Press, 2011). Moreover, a special issue on causality in the

[1] See http://www.caeits2011.ugent.be/ [accessed on May 1, 2012].

[2] See http://www.kent.ac.uk/secl/philosophy/jw/cits.htm [accessed on May 1, 2012].

biomedical and social sciences will be published in *Studies in History and Philosophy of Science*.

True to this tradition, we proudly present a first selection of papers from *Causality and Explanation in the Sciences* (CaEitS2011) in this issue of *Theoria*. In addition, a number of other selected papers will be published in *Erkenntnis*.

The first three papers in this issue each focus on issues concerning causality and explanation in a particular scientific discipline: the social sciences, epigenetics, and climate science. We will start with the social sciences. At what level should we expect social causation to operate: at the social macro-level or at the individual micro-level? And what is the relation between these two levels? In "Explanatory Autonomy and Coleman's Boat," Daniel Little opposes this dualistic micro-macro view: we also need to include a range of meso-level causal relations. But this still leaves open the question about the relation between these levels. Therefore, Little investigates whether an actor-centered social ontology can admit of relatively autonomous social causal explanations. He endorses the requirement that social structures and causes require "microfoundations" and argues that the examples of other special sciences demonstrate the validity of the idea of "relative explanatory autonomy" in the case of social causal reasoning. These considerations provide a basis for affirming the legitimacy of causal statements about meso-level causal powers and relations. The result is a 'limited but significant amendment' to the agenda of analytic sociology and its model of social causation represented by Coleman's boat.

In his "Causal explanation beyond the gene: manipulation and causality in epigenetics," Jan Baedke deals with the interrelationship between causal explanation and methodology in the relatively young discipline of epigenetics. Epigenetics basically represents a heterogeneous field that focuses on non-genetic inheritance phenomena. It thus challenges gene centrism and asks for a broader notion of heredity that should be taken into consideration for inheritance and evolution. Based on cases from molecular and ecological epigenetics, Baedke shows that Jim Woodward's interventionist account of causation captures essential features about how epigeneticists using highly diverse methods, i.e. laboratory experiments and purely observational studies, think about causal explanation. He argues that interventionism thus qualifies as a useful unifying explanatory approach when it comes to cross-methodological research efforts: It can act as a guiding rationale (i) to link causal models in molecular biology with statistical models derived from observational data analysis and (ii) to identify test-criteria for reciprocal transparent studies in different fields of research, which is a shared issue across the sciences.

In the third paper, "The key role of causal explanation in the climate change issue," Francesca Pongiglione argues that the adoption of pro-environment behaviour in the context of climate change is favoured by the understanding of causal passages within climate science. Tackling climate change is not only a matter of reaching international agreements imposing limits on CO2 emissions. Psychologists and behavioural scientists have started giving increasing attention to the role of individual behaviour in these matters and to the elements that influence the decision process that leads individuals to adopt pro-environment behaviour: personal values, attitudes and moral norms,

risk perception and knowledge among many others. In this paper, Pongiglione focuses in particular on the role of causal knowledge. The understanding of the causes of climate change is necessary in order to be able to take mitigation actions (the subject needs to be aware of its role as a causal agent). Conversely, the understanding of the consequences of climate change is essential for rationally managing the risks, especially in cases where adaptation is needed rather than simple mitigation. The case of ozone depletion confirms this view: the understanding of its causal dynamics played a major role in people's behavioural response.

In the fourth paper, "Warranting the use of causal claims: a non-trivial case for interdisciplinarity," Menno Rol and Nancy Cartwright also focus on the role of causal knowledge in policy, and on the conditions that should be satisfied for causal claims to be useful in a given case. Oftentimes, inaccurate inferences are made about target policy situations based on scientific studies – even good scientific studies – as Rol and Cartwright show by means of a couple of examples (such as the failed Bangladesh Integrated Nutrition Program, BINP, which was based on a Tamil Nadu project, TINP). The usual diagnosis is that the studies in question lack 'external validity', which means that the same results do not hold in the target as in the study. But that's a label that just repeats what we already knew, Rol and Cartwright argue. As a remedy, they offer a deeper analysis in which they isolate two reasons why inferences from study to target fail. First, policy variables do not produce results on their own; they need helping factors. The distribution of helping factors is likely to be unique or local for each study, so one cannot expect external validity to be all that common. Second, researchers often give too concrete a description of the cause in the study for it to carry over to the target. Abstraction is necessary to get causes that travel. There is no sure-fire way to guard against these problems. But the unavailability of one perfect tool does not imply there are no second best contrivances. This analysis points to the need for interdisciplinarity and to the demand to focus not on the study – as the expression 'external validity' invites you to do – but on the target. The call for interdisciplinary approaches to real life problems is common since it is widely acknowledged that what happens in the real world seldom falls under the auspices of any single research domain. In short, two general pointers for Good Practice in policy advice follow from their diagnosis: focus on the concrete details in the target and use cross discipline heuristics that diversify background knowledge.

Finally, Lorenzo Casini tackles the topic of causality at a more abstract level, viz. from an inferentialist viewpoint. According to the inferentialist view of causality, causality is a sort of 'inference licence'. The meaning of causal claims is constituted by and analysable in terms of the rules of inference they obey (inferences to sentences that warrant the causal claims as well as inferences to sentences that are warranted by them). In his "Causation: Many Words, One Thing?", Casini asks how many notions of cause there are. The causality literature is witnessing a flourishing of pluralist positions. Focussing on a recent debate on whether interpreting causality in terms of inferential relations commits one to semantic pluralism (as Julian Reiss has argued recently) or not (as Jon Williamson claims), Casini argues that inferentialism is compatible with a 'weak' form of monism, where causality is envisaged as one, vague cluster

concept. He offers two arguments for this claim, one for vagueness, one for uniqueness. Finally, he qualifies in what sense the resulting form of monism is 'weak'. It is weak because the issue of what 'causes' means cannot be settled once and for all, by either scientists or philosophers. If our concepts are dynamic, only partly constrained by our practices and Nature's inputs and outputs to such practices, we can only try to interpret concepts on-the-fly.

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