

Dispositions, Causes and Propensities in Science

Guest Editors: Mauricio Suárez (Universidad Complutense de Madrid) and Alexander Bird (University of Bristol), *Theoria*, 19, 3, September 2004.

Presentación / Introduction

All the papers in this volume (like those in its predecessor – the monographic section that I edited for *Theoria* in 2000 entitled *Causality in Physics*)¹ are original contributions to a set of issues that lie at the cutting-edge of philosophical research. They have been contributed especially for this issue of *Theoria*, and have not been previously published anywhere else. The issues that they deal with – and the methods employed in doing so – are at the forefront of philosophical research in the world at large – and in particular in the anglophone world. With all probability these papers will be cited and referred to in years to come by other authors and in other essays published in other similarly prestigious journals.

Neither is this a mottled collection or assortment of papers put together with the only aim of publication. Just like those papers in its predecessor volume, the papers appear here together for a reason: they complement each other well, for they deal with the same set of issues from different perspectives, and they have been written attending to that common set of issues. Alexander Bird (“Antidotes all the way down?”) reviews the literature on the conditional analysis of dispositions, and the problems and difficulties that arise when “finks” and “antidotes” are considered. He finds that finks are not as problematic for a conditional analysis of fundamental dispositions (i.e. those dispositions that there is no further set of categorical properties that they could be reduced to). Can antidotes be similarly eliminated? Bird shows that on a natural analysis, antidotes generally give rise to *ceteris paribus* laws. Hence if it could be shown that fundamental dispositions do not suffer from antidotes, we would then be able to conclude that the fundamental laws of physics are not *ceteris paribus* laws. He ends by offering some arguments to that effect.

My contribution (“Causal Processes and Propensities in Quantum Mechanics”) is an analysis of Van Fraassen’s 1982 argument against common cause models for the EPR correlations, which several commentators have taken to refute causal realism. I find that far from refuting causal realism, this argument actually provides an excellent guide to the different possible causal accounts of EPR. I then go on to show how to use the different causal models in order to develop different accounts of quantum propensities. Some of the quantum features of these propensities, such as their “non-locality” might add grist to Bird’s mill on finks and antidotes at the fundamental level.

Alice Drewery (“A Note on Science and Essentialism”) provides arguments against the view that there are metaphysically necessary laws – grounded on the essential dispositional properties of fundamental entities – that can be empirically discovered by science. Her conclusion points towards a dilemma: either there are such laws – grounded upon fundamental dispositional properties – but science cannot empirically discover the necessary character of such laws; or the entities are not themselves

¹ *Theoria*, 15, 3, pp. 5-128.

fundamental and there is another layer of yet more fundamental entities – a fact that science *could* discover. But if the latter, Drewery’s argument could, presumably, be re-applied at this more fundamental level.

All the papers in this volume share a belief in (at the very least the possibility of) irreducible dispositions – or propensities – at the fundamental level. But Agustín Vicente (“The Role of Dispositions in Explanations”) argues further that the appeal to dispositional properties might turn out to be essential in teleological explanations even if these properties are predicated of, presumably non-fundamental entities, such as psychological or biological properties. He points out that even if the dispositional or functional properties in those sciences could be reduced to categorial properties, the explanations couched in dispositional terms might not be dispensible. Dispositional properties thus have non-dispensible explanatory power even when they can be reduced to some categorial basis.

Finally, Nicholas Maxwell (“Does Probabilism Solve the Great Quantum Mystery?”) provides an introduction and state-of-the-art summary of his long standing and well-known propensity interpretation of quantum mechanics. He criticises the orthodox interpretation of quantum mechanics (the Copenhagen interpretation) for not being committed enough to the idea that quantum entities interact in probabilistic fashion and develops his own alternative.

We all met to discuss these issues together at a workshop which took place at the Instituto de Filosofía in the Consejo Superior de Investigaciones Científicas in Madrid on 15th December 2003. The symposium was organised under the umbrella of the research network “Causality, Determinism and Probability in Quantum Mechanics and Relativity Theory”, funded by the Spanish Ministry of Education and Science (Science and Technology) with reference BFF2002-01552. I would like to thank the Instituto de Filosofía for making their venue available for the occasion, and particularly Eulalia Pérez Sedeño for hosting us.

Most of the papers collected here were presented at the workshop, and we have all had the opportunity to discuss these issues between us, and with several other interested participants – at the time of the symposium and later on over email. I would like to thank all the participants at the symposium, who came from all over Spain and England. In particular many thanks to those who offered to chair the sessions (Manuel García-Carpintero, José Díez, Carl Hoefer, Iñaki San Pedro). I also would like to thank the other members of the research network BFF2002-01552 (Carl Hoefer, Iñaki San Pedro, Henrik Zinkernagel) for their unfailing support over the last couple of years, and for their very active participation and help during the workshop. Thanks are also due to my co-guest editor, Alexander Bird. Finally I would like to acknowledge the support and encouragement of the *Theoria* team, and in particular its editor-in-chief Andoni Ibarra, and to thank him for the patience and care taken in producing this monographic section.

Mauricio Suárez,
Department of Logic and Philosophy of Science,
Universidad Complutense de Madrid,
28040 Madrid, Spain.
Email: msuarez@filos.ucm.es

Contributors

Alexander Bird is Professor of Philosophy at the University of Bristol. He was previously Reader and Head of the Department of Philosophy at the University of Edinburgh. His research concerns the metaphysics and the epistemology of science. He has published several papers on laws of nature and modal metaphysics, as well as on other topics in the philosophy of science. He is the author of *Philosophy of Science* (Routledge) and *Thomas Kuhn* (Acumen / Princeton / Tecnos).

Address: Alexander Bird, Professor, Department of Philosophy, University of Bristol, 9 Woodland Road, Bristol BS8 1TB, United Kingdom. Email: alexander.bird@bris.ac.uk

Mauricio Suárez is Profesor Titular (Associate Professor) in Logic and Philosophy of Science at Universidad Complutense de Madrid. He previously taught at Oxford, St Andrews and Bristol Universities, and was a research fellow at Northwestern University. He has published widely on the philosophy of physics, particularly quantum mechanics, and on general issues in the philosophy of science, such as scientific epistemology and representation.

Address: Departamento de Lógica y Filosofía de la Ciencia, Universidad Complutense de Madrid, 28040 Madrid, Spain. Email: msuarez@filos.ucm.es

Agustín Vicente is Profesor Asociado (Assistant Professor) in Logic and Philosophy of Science at Valladolid University. He has worked on mental causation, and is currently also working on the relationships between language and thought. He has published papers on these two topics in journals such as *Erkenntnis*, *Mind and Language*, *Theoria* and *Minds and Machines*.

Address: Department of Philosophy, University of Valladolid. Email: agusvic@fyl.uva.es

Alice Drewery is Lecturer in Philosophy at the University of Reading. She has published on laws of nature, particularly *ceteris paribus* laws, and issues in the metaphysics of science. She is editor of the collection *Metaphysics in Science*, to be published by Blackwell in 2006.

Address: Department of Philosophy, University of Reading, RG6 6AA, United Kingdom. Email: a.e.drewery@reading.ac.uk

Nicholas Maxwell is Emeritus Reader in Philosophy of Science at University College London. He has devoted much of his working life to trying to get across the idea that we need a revolution in academic inquiry so that the basic aim becomes to promote wisdom and not just acquire knowledge. His books include *From Knowledge to Wisdom* (Blackwell, 1984), *The Comprehensibility of the Universe* (OUP, 1998), *The Human World in the Physical Universe* (Rowman and Littlefield, 2001), and *Is Science Neurotic?* (Imperial College Press, November 2004).

Address: University College London. Email: nicholas.maxwell@ucl.ac.uk

Analytical Summaries:

Alexander Bird: Antidotes all the Way Down?

This paper explores the question: can fundamental dispositions (which have no distinct causal basis) suffer from finks and antidotes? I use my response to shed light on the question: can the fundamental laws of physics be *ceteris paribus* laws?

Mauricio Suárez: Causal Processes and Propensities in Quantum Mechanics

I offer an alternative interpretation of Van Fraassen's influential arguments against causal realism in quantum mechanics. These arguments provide in fact a good guide to the different causal models available for the Einstein-Podolsky-Rosen correlations, which in turn shed light on the nature of quantum propensities.

Agustín Vicente: The Role of Dispositions in Explanations

According to a model defended by some authors, dispositional concepts can be legitimately used in causal explanations, although such a use is not necessary. I argue, however, that there is a kind of use of dispositions in explanations that does not fall within this model: we will miss some explanations if we forsake dispositional concepts and explanations.

Alice Drewery: A Note on Science and Essentialism

I argue that Bird's extension of Kripke-Putnam style essentialist arguments fail against Humeanism fail because a) they rely on controversial intuitions about the natures of substances which no Humean would accept and b) neither scientific practice nor particular empirical facts can determine the nature of causal necessity.

Nicholas Maxwell: Does Probabilism Solve the Great Quantum Mystery?

I put forward a micro realistic, probabilistic version of quantum theory, which specifies the precise nature of quantum entities thus solving the quantum wave/particle dilemma, and which both reproduces the empirical success of orthodox quantum theory, and yields predictions that differ from orthodox quantum theory for as yet unperformed experiments.