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Models as Make-Believe

Imagination, Fiction and Scientific Representation

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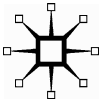

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For Angela

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Series Editor's Foreword

The intention behind this series is to offer a new, dedicated publishing forum for the kind of exciting new work in the philosophy of science that embraces novel directions and fresh perspectives. To this end, our aim is to publish books that address issues in the philosophy of science in the light of these new developments, including those that attempt to initiate a dialogue between various perspectives, offer constructive and insightful critiques, or bring new areas of science under philosophical scrutiny.

Adam Toon's provocative and exciting new book fits the series remit perfectly. The nature of scientific representation has become a major topic within the philosophy of science that has attracted considerable attention, not least in part because of the possibility for fruitful cross-fertilization with the philosophy of art, where, of course, this issue has been discussed in detail. However, much of the focus so far has concerned issues and concerns associated with representation in painting, for example, and Toon takes the discussion in an entirely new direction by drawing upon the philosophy of literature and the way in which fiction is treated philosophically. He is not alone, of course, in seeing this fictionalist aspect as constituting a central feature of scientific models which, as he says, are typically taken to be true of no real object. However, rather than taking the models themselves to be abstract or fictional, Toon imports Walton's 'pretence' analysis of fictions from the philosophy of literature and develops it in this context. On this view models are regarded as 'props' in something akin to games of make believe, which represent the world by prescribing 'imaginings' about it. This offers an entirely new and thought provoking perspective on the issue of the nature and role of representation in science.

Thus, this book represents a novel approach that not only further extends and develops the interconnections between the philosophy of science and the philosophy of art, but also tackles a number of major concerns in the philosophy of science to do with the nature and role of models and modelling. Furthermore, it does so in the

context of detailed case studies from chemistry, illustrating how visual and tactile forms of participation may be involved in modelling and how this supports forms of 'imagined experiments'. In this manner Toon takes the debate forward and away from the rather simplistic examples that have been employed in the literature so far, towards those features of the scientific enterprise that are more complex, more interesting and closer to actual practice.

In all these ways then – in drawing on the philosophy of literature, in offering a radically new account of representation in science and in deploying case studies that are closer to actual scientific practice than the examples usually presented – this book accomplishes precisely what we set out to do with this series.

Steven French
Professor of Philosophy of Science
University of Leeds

Preface

This book began life as a doctoral thesis in the Department of History and Philosophy of Science at the University of Cambridge. My first experience of the HPS Department was as an undergraduate when, after two years of a degree in maths and physics, I decided on a change of direction, and spent my final year studying history and philosophy of science. It proved to be an enormously exciting, rewarding and challenging year, and I feel extremely privileged to have been welcomed into such an open, friendly and stimulating intellectual environment. I am particularly grateful to my supervisor, Martin Kusch, for all of his hard work, support and encouragement throughout my PhD. I feel very lucky to have had such an extraordinarily able and conscientious supervisor for my doctoral work. Some of the most inspiring and memorable experiences of my time in the HPS Department came in Peter Lipton's wonderful lectures, and I feel extremely fortunate that I was able to receive Peter's comments on early drafts of my thesis.

Since leaving Cambridge I have been lucky enough to find a home in another exceptionally friendly, supportive and stimulating environment for philosophical study, in the Department of Philosophy at the University of Bielefeld. I would like to thank all of my colleagues in Bielefeld, especially Martin Carrier, Ulrich Krohs, Maria Kronfeldner, Johannes Lenhard, Cornelis Menke, Alex Wiebke and Torsten Wilholt, for all of their support and for making me feel so welcome. Thanks also to Torsten for very helpful comments on the first few chapters of the book, and to the students in my course on 'Representation in Science and Art', for their challenging and thought-provoking criticisms of work in the field (including my own). And thank you especially to Martin Carrier, without whose support this book would not have been possible.

Many other people have given extremely helpful suggestions, comments, criticisms and advice during my work on the book. I am particularly grateful to Martin Thomson-Jones for his generous support and encouragement for the project, and for extremely

helpful and constructive criticisms of a draft of the book. His own work has done a great deal to help me understand the problems that an account of scientific modelling must solve. A special thank you to Stacie Friend, too, both for her friendship and encouragement during my PhD, and for helpful and enjoyable discussions on fiction, imagination and much else besides. Thanks also to Roman Frigg for his generous support, for lots of stimulating discussions on where we agree and disagree, and for inviting me to so many excellent events on models and fiction during my PhD, including the 'Fictionalism' reading group at LSE during 2007–8. Thanks to participants in this group for extremely interesting and helpful discussion.

My debt to Kendall Walton is considerable, and engaging with his work has taught me a huge amount, as well as being a lot of fun. I am also grateful for his kind and constructive comments on the project, although of course the responsibility for my use (or misuse) of his ideas is entirely my own. In addition, I would like to thank Nancy Cartwright, Soraya de Chadarevian, Anjan Chakravartty, Hasok Chang, Gabriele Contessa, Tim Crane, John Forrester, Ronald Giere, Peter Godfrey-Smith, Nick Hopwood, Nick Jardine, Mary Leng, Aaron Meskin, Chris Pincock, Eleanor Robson, Simon Schaffer, Jim Secord, Mark Sprevak, Mauricio Suárez, Liba Taub, Paul Teller and Michael Weisberg for very helpful discussion and correspondence. Thanks to Tim Lewens for his help and support, as well as very helpful comments and criticisms on my doctoral thesis, and to Marina Frasca-Spada, for her kind support, and for supervising an undergraduate thesis on Hume that helped to get me hooked on philosophy. And thanks also to Stephen Boulter, Mark Cain, Dan O'Brien, Constantine Sandis and my students at Oxford Brookes, for a hugely enjoyable term spent there.

I have presented some of the ideas from the book at many conferences and workshops over the past few years, including the 'Beyond Mimesis and Nominalism' conference held at LSE in June 2006, the Philosophy Workshop in Cambridge in June 2006, the CMM Graduate Conference in Leeds in June 2007, the 'Scientific Models: Semantics and Ontology' workshop in Barcelona in July 2007, the Inaugural Conference of the Centre for Literature and Philosophy at the University of Sussex in June 2008, a Departmental Seminar in the HPS Department at Cambridge in November 2008, the 'Models and Fiction' workshop at LSE in March 2009, a Departmental

Colloquium at the Leibniz Universität in Hannover in May 2010, a Departmental Seminar at Oxford Brookes University in December 2010, and the Biennial Conference for Philosophy of Science in Practice in Exeter in June 2011. I would like to thank participants at all of these events for helpful and thought-provoking questions, comments and criticism, particularly my commentator in Barcelona, Manuel García-Carpintero.

Research for this book was supported by The Arts and Humanties Research Council, the Darwin Trust of Edinburgh, the Williamson and Rausing Funds of the Department of History and Philosophy of Science, Cambridge and King's College, Cambridge. I am extremely grateful to all of these institutions for their support. Thanks also to those who took part in the empirical study in Chapter 5. And thank you to Steven French, for including the book in this series, and to Pri Gibbons at Palgrave Macmillan for her help during the writing process.

All in all, this book has been a long time in the making, and I would like to thank my friends and family, especially my mum, dad and sister, for all of their love and support over the years, as well as the wonderful teachers at Highfields School in Matlock, for making me love learning in the first place. Finally, I would like to thank my wife, Angela, for just about everything. This book is dedicated to her.

Acknowledgements

Parts of this book incorporate revised and reworked versions of material from the following articles. I am grateful to the editors and publishers involved for permission to use that material here.

The ontology of theoretical modelling: models as make-believe. *Synthese*, *172*(2), 301–15.

Models as make-believe. In R. Frigg and M. Hunter (eds), *Beyond Mimesis and Convention: Representation in Art and Science* (pp. 71–96). Dordrecht: Springer.

Novel approaches to models. *Metascience*, *19*(2), 285–8.

Playing with molecules. *Studies in History and Philosophy of Science*, *42*, 580–9.

I would also like to thank the Museum Boerhaave, Leiden and the Museum for the History of Sciences, Ghent University for permission to use the images of van't Hoff and Kekulé's models in Chapter 4.