Synthese Library

Studies in Epistemology, Logic, Methodology, and Philosophy of Science

Volume 477

Editor-in-Chief

Otávio Bueno, Department of Philosophy, University of Miami, Coral Gables, USA

Editorial Board Members

Berit Brogaard, University of Miami, Coral Gables, USA

Steven French, University of Leeds, Leeds, UK

Catarina Dutilh Novaes, VU Amsterdam, Amsterdam, The Netherlands

Darrell P. Rowbottom, Department of Philosophy, Lingnan University, Tuen Mun, Hong Kong

Emma Ruttkamp, Department of Philosophy, University of South Africa, Pretoria, South Africa

Kristie Miller, Department of Philosophy, Centre for Time, University of Sydney, Sydney, Australia

The aim of *Synthese Library* is to provide a forum for the best current work in the methodology and philosophy of science and in epistemology, all broadly understood. A wide variety of different approaches have traditionally been represented in the Library, and every effort is made to maintain this variety, not for its own sake, but because we believe that there are many fruitful and illuminating approaches to the philosophy of science and related disciplines.

Special attention is paid to methodological studies which illustrate the interplay of empirical and philosophical viewpoints and to contributions to the formal (logical, set-theoretical, mathematical, information-theoretical, decision-theoretical, etc.) methodology of empirical sciences. Likewise, the applications of logical methods to epistemology as well as philosophically and methodologically relevant studies in logic are strongly encouraged. The emphasis on logic will be tempered by interest in the psychological, historical, and sociological aspects of science. In addition to monographs *Synthese Library* publishes thematically unified anthologies and edited volumes with a well-defined topical focus inside the aim and scope of the book series. The contributions in the volumes are expected to be focused and structurally organized in accordance with the central theme(s), and should be tied together by an extensive editorial introduction or set of introductions if the volume is divided into parts. An extensive bibliography and index are mandatory.

Cristián Soto Editor

Current Debates in Philosophy of Science

In Honor of Roberto Torretti



Editor
Cristián Soto
Departamento de Filosofía
Universidad de Chile
Ñuñoa, Chile
Newton International Fellow
British Academy/CPNSS, LSE

London, UK

ISSN 0166-6991 ISSN 2542-8292 (electronic) Synthese Library ISBN 978-3-031-32374-4 ISBN 978-3-031-32375-1 (eBook) https://doi.org/10.1007/978-3-031-32375-1

© Springer Nature Switzerland AG 2023

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors, and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, expressed or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

This Springer imprint is published by the registered company Springer Nature Switzerland AG The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

In Memoriam Roberto Torretti

Roberto Torretti passed away on 12 November 2022. His life and work have received extensive recognition and endless praise from his friends and colleagues worldwide. Even though he did not get to see the final version published, he was familiar with this book. The origins of the volume go back to February 2019, when I had the fortunate chance to discuss the project with Otávio Bueno, who strongly encouraged me to proceed swiftly. From the beginning, Roberto Torretti was enthusiastically involved, suggesting names of potential contributors, and providing advice on the book's outline. He felt humbled when he knew the final table of contents, and he was grateful to the authors for their contributed chapters. This volume represents a collective effort to honor Roberto Torretti's name and place in the philosophy of science. He represents an outstanding example of life-long devotion to the field, with exceptional standards of passion, rigor and professionalism that will continue to inspire many over the time.

London, England, UK 9 March 2023 Cristián Soto



Picture 1 Roberto Torretti at the age of 24. Picture taken by Carla Cordua, Chilean philosopher and Roberto Torretti's wife



Picture 2 Roberto Torretti at the age of 70. By Pablo Hermansen

Acknowledgments

While editing this book, I amassed various debts to many friends and colleagues. First and foremost, I thank Roberto Torretti, who was incredibly generous with his time, engaging in extended e-mail correspondence and arranging online meetings while the COVID-19 pandemic was at its peak. We extensively discussed his works and this volume's goals in his honor. He facilitated an updated list of his publications and some photos we include now on these pages. Roberto Torretti's outstanding example of intellectual rigor and devotion to the philosophy of science goes almost unparalleled in the discipline.

Likewise, with his usual insight and genuine interest in making other people's works thrive, Otávio Bueno, editor-in-chief of the Synthese Library Series, encouraged this project from the very beginning. He offered his guidance throughout the process. I am deeply grateful for his ongoing support in this and other ventures.

This book was only possible thanks to the trust of the authors in this editorial project. They have shared valuable results of their investigations, and I have been fortunate to have the chance to bring them together to honor Roberto Torretti's life and work. Many thanks to Hernán Lucas Accorinti, Pablo Acuña, Jonas Arenhart, Katherine Brading, Otávio Bueno, Jeremy Butterfield, Alejandro Cassini, Aldo Filomeno, Sebastián Fortin, Roman Frigg, Henrique Gomes, Manuel Herrera, Jesús Jaimes, Qiu Lin, Olimpia Lombardi, John D. Norton, Patricia Palacios, Thomas Ryckman, and Charlotte Werndl.

I thank the Departamento de Filosofía, Universidad de Chile, for providing me with the necessary conditions to undertake this project. And to the British Academy for awarding me a Newton International Fellowship to conduct research at the Centre for the Philosophy of Natural and Social Sciences, LSE, UK, which finally allowed me to bring the volume to a good end. I am particularly indebted to Bryan Roberts, the Centre's Director, and to Roman Frigg for kindly hosting me at the Centre, as well as for his invaluable guidance in this and other projects.

For making it all worthwhile and being a constant source of joy and adventure, I thank Dominique and Damián – to them with endless love.

Contents

1	Editor's Introduction: Celebrating Roberto Torretti	1
2	Roberto Torretti's Philosophy of Science Cristián Soto	15
3	Du Châtelet on Absolute and Relative Motion Katherine Brading and Qiu Lin	37
4	Effective Field Theories: A Case Study for Torretti's Perspective on Kantian Objectivity	61
5	A Kantian-Rooted Pluralist Realism for Science	81
6	Mathematical Fictionalism Revisited	103
7	Functionalism as a Species of Reduction Jeremy Butterfield and Henrique Gomes	123
8	Intertheoretic Reduction in Physics Beyond the Nagelian Model Patricia Palacios	201
9	$\label{lem:condition} \begin{tabular}{ll} \textbf{Inductive Inferences on Galactic Redshift, Understood Materially} \dots \\ \textbf{John D. Norton} \end{tabular}$	227
10	When Does a Boltzmannian Equilibrium Exist? Charlotte Werndl and Roman Frigg	247
11	Boltzmannian Non-Equilibrium and Local Variables	275

x Contents

12	Scientific Understanding in Astronomical Models from Eudoxus to Kepler	289	
13	Reinterpreting Crucial Experiments Alejandro Cassini	341	
14	Non-reflexive Logics and Their Metaphysics: A Critical Appraisal	367	
15	Typicality of Dynamics and Laws of Nature	391	
16	The Case of Phonons: Explanatory or Ontological Priority	419	
App	Appendix: Publications by Roberto Torretti		

Contributors

Hernán Lucas Accorinti CONICET and Universidad de Buenos Aires, Buenos Aires, Argentina

Pablo Acuña Institute of Philosophy, Pontificia Universidad Católica, Santiago, Chile

Jonas R. B. Arenhart Department of Philosophy, Universidade Federal de Santa Catarina, Florianópolis, Brazil

Katherine Brading Department of Philosophy, Duke University, Durham, NC, USA

Otávio Bueno Department of Philosophy, University of Miami, Coral Gables, FL, USA

Jeremy Butterfield Trinity College, University of Cambridge, Cambridge, UK

Alejandro Cassini CONICET and Universidad de Buenos Aires, Buenos Aires, Argentina

Aldo Filomeno Institute of Philosophy, Pontificia Universidad Católica de Valparaíso, Valparaíso, Chile

Sebastián Fortin CONICET and Universidad de Buenos Aires, Buenos Aires, Argentina

Roman Frigg Department of Philosophy, Logic and Scientific Method, and CPNSS, LSE, London, UK

Henrique Gomes Trinity College, University of Cambridge, Cambridge, UK

Manuel Herrera CONICET and Universidad de Buenos Aires, Buenos Aires, Argentina

Jesús Alberto Jaimes Arriagada CONICET and Universidad de Buenos Aires, Buenos Aires, Argentina

xii Contributors

Qiu Lin Department of Philosophy, Duke University, Durham, NC, USA

Olimpia Lombardi CONICET and Universidad de Buenos Aires, Buenos Aires, Argentina

John D. Norton Department of History and Philosophy of Science, University of Pittsburgh, Pittsburgh, PA, USA

Patricia Palacios Department of Philosophy, University of Salzburg, Salzburg, Austria

Thomas Ryckman Department of Philosophy, Stanford University, Stanford, CA, USA

Cristián Soto Departamento de Filosofía, Universidad de Chile,Ñuñoa, Chile Newton International Fellow, British Academy/CPNSS, LSE, London, UK

Charlotte Werndl Department of Philosophy, University of Salzburg, Salzburg, Austria