PHILOSOPHY Of SCIENCE

Volume 89 Number I January 2022



Philosophy of Science

Editorial Board: Andrea Woody, Editor-in-Chief

Kevin Elliott, Alan C. Love, Angela Potochnik,

Kevin Zollman

Katie Steele, James Owen Weatherall, and Charlotte Werndl, Associate Editors

Jason McKenzieAlan HájekAlan RichardsonAlexanderStephan HartmannAlex RosenbergAnna AlexandrovaGeoffrey HellmanLaura RuetscheJeff BarrettDon HowardRose-Mary SargentRobert BattermanNick HuggettKristin Shrader-Frechette

William Bechtel Marc Lange Lawrence Sklar Gordon Belot Helen Longino Brian Skyrms Jane Maienschein Chris Smeenk Cristina Bicchieri Katherine Brading Michela Massimi Miriam Solomon Roberta Millstein Richard Bradley P. Kyle Stanford Sandra Mitchell Paul Teller Craig Callender Nancy Cartwright Mary Morgan Derek Turner Lindley Darden Wayne Myrvold Jos Uffink Michael Dickson John Norton David Wallace Stephen Downes Samir Okasha C. Kenneth Waters David Papineau Marcel Weber John Dupré Kenny Easwaran Wendy Parker Rob Wilson Doreen Fraser Thomas Polger James Woodward

Managing Editor: Kayla Mehl-Hutchinson

Governing Board of the Association

Michael Friedman

Peter Gärdenfors

President: John Dupré, University of Exeter

President Elect: Michela Massimi, University of Edinburgh Past President: Alison Wylie, University of British Columbia

Julian Reiss

Hanne Andersen Soazig Le Bihan Alisa Bokulich Anya Plutynski Hasok Chang Jutta Schickore Kareem Khalifa Sean A. Valles

Executive Director: Max Cormendy

Volume 89 • Number I • January 2022

Philosophy of Science

Contents

- 1 Explaining Machine Learning Decisions
 JOHN ZERILLI
- 20 Understanding Deep Learning with Statistical Relevance
 TIM RÄZ
- 42 Scientific Theories as Bayesian Nets: Structure and Evidence Sensitivity Patrick Grim, Frank Seidl, Calum McNamara, Hinton E. Rago, Isabell N. Astor, Caroline Diaso and Peter Ryner
- 70 Energy Requirements Undermine Substrate Independence and Mind-Body Functionalism PAUL THAGARD
- 89 What Counts as a Memory? Definitions, Hypotheses, and "Kinding in Progress"

 DAVID COLAÇO
- 107 Does Neuroplasticity Support the Hypothesis of Multiple Realizability?
 Amber Maimon and Meir Hemmo
- 128 Accuracy-First Epistemology Without Additivity RICHARD PETTIGREW
- 152 There Is Cause to Randomize
 Cristian Larroulet Philippi

Discussion Notes

- 171 Two Notions of Ecological Function
 Antoine C. Dussault
- 180 Answers at Gunpoint: On Livengood and Sytsma's Revolver Case
 Alexander Max Bauer and Jan Romann

Essay Review

193 Recent Work in the Philosophy of Medicine: An Essay Review John E. Huss

Book Reviews

- 202 Review of Jeffrey A. Barrett's The Conceptual Foundations of Quantum Mechanics Benjamin H. Feintzeig
- 205 Review of Jean Gayon and Victor Petit's *Knowledge of Life Today*DAVID DEPEW

Philosophy of Science (ISSN 0031-8248) is published January, April, July, October, and December by Cambridge University Press, One Liberty Plaza, New York, NY 10006, USA/Cambridge University Press, University Printing House, Shaftesbury Road, Cambridge CB2 8BS, UK.

Periodicals postage paid a New York, NY, and at additional mailing points.

Postmaster: Send address changes in the USA, Canada, and Mexico to *Philosophy of Science*, Cambridge University Press, Journals Fulfillment Department, One Liberty Plaza, 20th floor, New York, NY 10006. Send address changes elsewhere to *Philosophy of Science*, Cambridge University Press, Journals Fulfillment Department, UPH, Shaftesbury Road, Cambridge CB2 8BS, England.

Membership and Subscription Rates

Individual members of the PSA receive a subscription to the journal. Membership rates for 2022 are tiered based on income and start at \$36 print + electronic, \$27 e-only. To join the PSA visit: https://philsci.org/membership.php. Institutional print + electronic and e-only subscription rates are tiered according to an institution's type and research output: £230/\$320 to £470/\$650 print + electronic, £230/\$320 to £405/\$560 e-only. Institutional print-only is £255/\$350. Additional taxes may apply. Free or deeply discounted access is available for many institutions through Cambridge University Press's developing world country programme: https://www.cambridge.org/core/services/librarians/developing-country-programme. For additional rates, and any other subscription queries, please contact: journals@cambridge.org.

Copying Beyond Fair Use

Articles may be copied or otherwise reused without permission only to the extent permitted by Sections 107 and 108 of the US Copyright Law. Permission to copy articles for personal, internal, classroom, or library use may be obtained from the Copyright Clearance Center (http://www.copyright.com/). For all other uses, such as copying for general distribution, for advertising or promotional purposes, for creating new collective works, or for resale, please contact permissions@cambridge.org. Articles in the public domain may be used without permission, but it is customary to contact the author.

Articles appearing in *Philosophy of Science* are abstracted or indexed in Arts and Humanities Citation Index, Biological Abstracts, Bulletin Signalétique 519, Current Contents/Arts and Humanities, Current Contents/Social and Behavioral Sciences, Current Index to Statistics, Humanities Index, Index to Book Reviews in the Humanities, Isis Critical Bibliography, Language & Language Behavior Abstracts, Mathematical Reviews, Philosopher's Index, Philosophic, Psychological Abstracts, Repertoire Bibliographique de la Philosophie, Social Sciences Citation Index, Sociological Abstracts.

© 2022 by Philosophy of Science Association. All rights reserved.