THE REVIEW OF SYMBOLIC LOGIC



Edited by

Jeremy Avigad, Coordinating Editor

Rosalie lemhoff

Hannes Leitgeb

Carsten Lutz

Paolo Mancosu

Graham Priest

Ian Proops

Alasdair Urguhart

Richard Zach

VOLUME 5 • NUMBER 3 • SEPTEMBER 2012 • ISSN 1755-0203

Copyright © 2012 by the Association for Symbolic Logic. All rights reserved.

Reproduction by photostat, photo-print, microfilm, or like process by permission only.



PUBLISHED QUARTERLY BY THE ASSOCIATION FOR SYMBOLIC LOGIC, INC. WITH SUPPORT FROM INSTITUTIONAL MEMBERS.

THE REVIEW OF SYMBOLIC LOGIC

Coordinating Editor

Jeremy Avigad

Departments of Philosophy and Mathematical Sciences Carnegie Mellon University

Editors

Rosalie Iemhoff

Department of Philosophy

Utrecht University

Hannes Leitgeb

Faculty of Philosophy, Philosophy of Science, and Study of Religion Ludwig-Maximilians-University, Munich

Carsten Lutz

Department of Computer Science

University of Bremen

Paolo Mancosu

Department of Philosophy

University of California, Berkeley

Graham Priest
The Graduate Center
City University of New York

Ian Proops

Department of Philosophy University of Texas at Austin

Alasdair Urquhart

Departments of Philosophy and

Computer Science University of Toronto

Richard Zach

Department of Philosophy University of Calgary

Advisory Board

Steve Awodey

Department of Philosophy Carnegie Mellon University

Hartry Field

Department of Philosophy New York University

Kit Fine

Departments of Philosophy

and Mathematics New York University

Michael Friedman

Department of Philosophy

Stanford University

Marcus Kracht

Department of Linguistic and

Literary Studies University of Bielefeld

John MacFarlane

Department of Philosophy and Group in Logic and

Methodology of Science

University of California, Berkeley

D.A. Martin

Departments of Mathematics

and Philosophy

University of California,

Los Angeles

Law rence Moss

Department of Mathematics

Indiana University

Rohit Parikh

Department of Computer and Information Science Brooklyn College, City University

of New York

Greg Restall

Department of Philosophy University of Melbourne

Colin Stirling

School of Informatics University of Edinburgh

James Tappenden

Department of Philosophy University of Michigan

Johan van Benthem Institute for Logic,

Institute for Lo Language

and Computation

University of Amsterdam and Department of Philosophy

Stanford University

Michiel van Lambalgen

Institute for Logic,

Language and

Computation and

Department of Philosophy University of Amsterdam

Rineke Verbrugge

Institute of Artificial Intelligence

University of Groningen

Dag Westerståhl

Department of Philosophy Gothenburg University

Mark Wilson

Department of Philosophy Pittsburgh University

TABLE OF CONTENTS

Introduction JUSTIN CLARKE-DOANE	379
An "i" for An i: Singular Terms, Uniqueness, and Reference STEWART SHAPIRO	380
The Set-Theoretic Multiverse JOEL DAVID HAMKINS	416
Cut for Core Logic NEIL TENNANT	450
On Ontology and Realism in Mathematics HAIM GAIFMAN	480

Subscription Information: *Review of Symbolic Logic* (ISSN 1755-0203) is published quarterly by Cambridge University Press for the Association for Symbolic Logic. Annual subscription rates for Volume 4 (2012): Institutional subscription rates, print and online: US \$680.00 in the USA, Canada, and Mexico; UK £415.00 + VAT elsewhere. Institutional subscription rates, online only: US \$572.00 in the USA, Canada, and Mexico; UK £368.00 + VAT elsewhere. Institutional subscription rates, print only: US \$645.00 in the USA, Canada, and Mexico; UK £385.00 + VAT elsewhere. Individual subscription rates, online only: US \$143.00 in the USA, Canada, and Mexico; UK £92.00 + VAT elsewhere. Individual subscription rates, print only: US \$162.00 in the USA, Canada, and Mexico; UK £97.00 + VAT elsewhere. Institutional subscription correspondence should be sent to: Cambridge University Press, 100 Brook Hill Drive, West Nyack, NY 10994, USA, for customers in the USA, Canada, or Mexico. Customers elsewhere should contact: Cambridge University Press, The Edinburgh Building, Shaftesbury Road, Cambridge CB2 8RU, UK.

Association for Symbolic Logic. Individual Members of the Association for Symbolic Logic receive a print subscription to *The Review of Symbolic Logic* as a benefit of membership. Requests for information, applications for membership, orders for back volumes, business correspondence, and notices and announcements for publication in the *The Bulletin of Symbolic Logic* should be sent to the Secretary-Treasurer of the Association: Charles Steinhorn, ASL, Box 742, Vassar College, 124 Raymond Avenue, Poughkeepsie, NY 12604, USA. The email address of the Association's business office is asl@vassar.edu. The ASL website is located at http://www.aslonline.org. Links from that site provide further information on the *Review* and on submitting papers for publication.

Coordinating Editor: Jeremy Avigad, Department of Philosophy, Carnegie Mellon University, Pittsburgh, PA 15213, USA. Email: avigad@cmu.edu.

Copyright: All rights reserved. No part of this publication may be reproduced, in any form or by any means, electronic, photocopy, or otherwise, without permission in writing from Cambridge University Press. Photocopying information for users in the U.S.A.: Copying for internal or personal use beyond that permitted by Sec. 107 or 108 of the U.S. Copyright Law is authorized for users duly registered with the Copyright Clearance Center (CCC) Transaction Reporting Service, provided that the appropriate remittance per article is paid directly to CCC, 222 Rosewood Drive, Danvers, MA 01923, USA. Specific written permission must be obtained for all other copying. General enquiries from the USA, Mexico, and Canada should be addressed to the New York office of Cambridge University Press http://www.cambridge.org/us/information/rights/contacts/newyork.htm; general enquiries from elsewhere should be addressed to the Cambridge office http://www.cambridge.org/ uk/information/rights/contacts/cambridge.htm; permission enquiries from Australia and New Zealand should be addressed to the Melbourne office http://www.cambridge.org/aus/ information/contacts melbourne.htm; enquiries regarding Spanish-language translation rights (only) should be addressed to the Madrid office http://www.cambridge.org/uk/ information/rights/contacts/madrid.htm

Copyright © Association for Symbolic Logic, 2012