

Logic, Methodology and Philosophy of Science

Proceedings of the
Fifteenth International Congress

Hannes Leitgeb
Ilkka Niiniluoto
Päivi Seppälä
Elliott Sober
Editors



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Proceedings of the 15th International
Congress (Helsinki)

Models and Modelling

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Edited by
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Ilkka Niiniluoto,
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and
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ISBN 978-1-84890-229-9

College Publications
Scientific Director: Dov Gabbay
Managing Director: Jane Spurr

<http://www.collegepublications.co.uk>

Printed by Lightning Source, Milton Keynes, UK

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Editors' preface

This volume contains papers based on invited lectures from the 15th International Congress of Logic, Methodology and Philosophy of Science, in Helsinki, Finland, on August 3-8, 2015. The CLMPS 2015 was held under the auspices of the International Union of History and Philosophy of Science (IUHPS), Division of Logic, Methodology, and Philosophy of Science (DLMPS), by the invitation of the Finnish National Committee for the Philosophy of Science, and hosted by the University of Helsinki. We have included in this book the opening statements by the representatives of the DLMPS, and the Local Organizing Committee.

In the traditional way, the Congress included six plenary lectures, 39 invited papers and 476 contributed papers distributed in 17 sections, and 172 papers in special symposia (including affiliated meetings and commission sessions). A complete list of the plenary lectures and invited papers appears on pages ix - xiii. This book includes 23 of the invited papers. Abstracts of all papers of the CLMPS, together with abstracts of papers of the Logic Colloquium 2015, were published in the Book of Abstracts in 2015 (clmps.helsinki.fi/materials/CLMPS_LC_bookofabstracts29.7.2015.pdf).

The process of editing the manuscripts into a camera ready version was led in Helsinki by Päivi Seppälä, the Congress Secretary of the CLMPS. Her effective team consisted M.Soc.Sc. Juho Pääkkönen, B.Phil. Leena Tulkki, and Ms. Hanna Pankka. We are grateful to all of them for their careful work. We also express our gratitude to King's College Publications and Managing Director Jane Spurr who wished to continue the tradition of publishing the Proceedings of the CLMPS in their series.

Munich, Helsinki, and Madison, WI, January 2017
Hannes Leitgeb, Ilkka Niiniluoto, Päivi Seppälä, Elliott Sober

Preface of the Division of Logic, Methodology, and Philosophy of Science (DLMPS)

Welcome to the 15th Congress on Logic, Methodology, and Philosophy of Science (CLMPS). The CLMPS is one of the most important activities of the Division of Logic, Methodology and Philosophy of Science (DLMPS) of the International Union for History and Philosophy of Science (IUHPS).

The DLMPS was founded in 1955, and currently has 31 ordinary members (representing countries) and seven international societies as international members. The first Congress took place in Stanford, California in 1960. One of its organizers was Patrick Suppes (1922-2014) who later became President of the DLMPS from 1975-1979; he passed away recently. Given his importance for the Division and our field, it is fitting that there will be a symposium on his work at the Helsinki Congress (Saturday, 8 August, 10am-12pm).

Since that first congress in Stanford in 1960, the CLMPS has been one of the most important global meetings of logicians and philosophers of science, taking place every four years and complementing national and regional meetings that occur more frequently. The Helsinki CLMPS continues this fine tradition. The programme for this Congress, and the abstracts in this volume, show that this Congress will provide a vibrant, probing, and multi-dimensional picture of our research field.

The DLMPS functions as the umbrella organization for logic and philosophy of science at the global level. The DLMPS facilitates discussion of developments in our fields in a number of commissions, some of which are shared with our sister division in the IUHPS, the Division of History of Science and Technology (DHST). In recent years, the two divisions have intensified their collaboration, and this will be visible at the Helsinki Congress in the form of a meeting of the Joint Commission (Friday, 7 August, 2:30pm-7pm; Saturday, 8 August, 10am-11am and 1:30pm-3:30pm), as well as symposia of commissions that are or are planning to be shared between the two divisions: the Teaching Commission, the International Association for Science and Cultural Diversity (IASCU), and the Commission on History and Philosophy of Computing (HaPoC).

The IUHPS is part of the International Council for Science (ICSU), for which the IUHPS plays a special role by providing a meta-perspective on the scientific enterprise, reflecting on scientific practices and institutions. DLMPS has taken this task seriously at the Helsinki Congress by organizing two special ICSU sessions relating to current global ICSU research projects. One is on "Future Earth and Models of Climate Change"; the other is on "Health and Welfare". In these sessions, scientists working on these projects will interact with philosophers of science. In 2014 and 2015, IUHPS has coordinated a project for ICSU entitled "Cultures of Mathematical

Research Training"; there will be a report on that project as part of the already mentioned meeting of the International Association for Science and Cultural Diversity (IASCUD).

In conclusion we, as representatives of the Executive Committee of DLMPS, want to thank Hannes Leitgeb, who chaired the Program Committee, and Ilkka Niiniluoto, who chaired the Local Organizing Committee, for their excellent work in planning this Congress. They and the members of their committees have worked hard and deserve our gratitude. We also want to thank the scholars who will be giving talks at the Congress. The success of our Congress is now in their hands!

Elliott Sober
President, DLMPS

Benedikt Löwe
Assistant Secretary General, DLMPS

Preface of the Local Organizing Committee

On behalf of the Local Organizing Committee (LOC) of the 15th international Congress of Logic, Methodology, and Philosophy of Science (CLMPS), held in Helsinki, August 3-8, 2015, I wish to thank all of those who came to the beautiful capital of Finland on August 3-8, 2015.

The great tradition of international congresses of LMPS, under the auspices of the Division of Logic, Methodology and Philosophy of Science (DLMPS), was started in 1960 at Stanford University. Every four years these meetings bring together logicians and philosophers of science from all over the world to present and discuss their current work. In addition to 45 plenary and invited speakers, the Call for Papers attracted 762 philosophers to submit their contributed papers and symposium proposals to the congress. The number of registered participants from 55 countries was 713.

The programme covered all systematic and historical aspects of formal logic, general philosophy of science, and philosophical issues of special sciences. The theme of the 15th Congress was “Models and Modelling”. A special feature of the CLMPS in 2015 was the co-location of the Logic Colloquium (LC), the European Summer Meeting of the Association for Symbolic Logic (ASL), in Helsinki, which allowed the participants also to follow a rich supply of lectures in mathematical logic.

The hosting University of Helsinki was established in 1640 as the Royal Academy of Turku. Its staff included a Professor of Theoretical Philosophy whose task was to teach logic or the art of thinking. When the Academy was moved to Helsinki 1828, it adopted the Humboldtian model of research-based education where philosophy played a leading academic role. Modern philosophy of science reached the University a century later, when Eino Kaila as the Professor of Theoretical Philosophy introduced the principles of logical empiricism. Kaila’s students – among them Georg Henrik von Wright, Oiva Ketonen, and Erik Stenius - and von Wright’s student Jaakko Hintikka transformed Helsinki to an important international centre of logic and philosophy of science. This philosophical approach was complemented in 1973 by the establishment of a new chair of Mathematical Logic at the Department of Mathematics.

Both von Wright (in 1963-65) and Hintikka (in 1965) are past presidents of the International Union of History and Philosophy of Science. Hintikka was an active participant as a speaker in both CLMPS and LC, but sadly passed away only a few days after the Congress.

The local organizers of the 15th Congress of LMPS included the Philosophical Society of Finland (founded in 1873 by Professor Thiodolf Rein), the section of Theoretical Philosophy of the Department of Philosophy, History, Culture and Art Studies, and the Finnish Centre of Excellence in the Philosophy of the Social Sciences (TINT). I wish to thank the members of our team, especially the congress secretary Päivi Seppälä, for

their excellent and skilful work.

We are most grateful to the sponsors of the Congress: DLMPS, the University of Helsinki, the Finnish Federation of Scientific Societies, the Finnish Academy of Sciences and Letters, the Council of Academies of Science, the Finnish Cultural Foundation, the Wihuri Foundation, TINT, and the City of Helsinki.

On behalf of the local organizers, I wish to thank Elliott Sober and Benedikt Löwe (DLMPS), Hannes Leitgeb (chair of the Programme Committee), and Jouko Väänänen (chair of the Local Organizing Committee of LC) for their effective co-operation.

The venue of the Congress was the neoclassical main building of the University of Helsinki, located in the middle of the compact downtown area. Summertime in Finland provided pleasant sunshine and white nights, and the participants were able to enjoy the blend of logic and philosophy with a friendly intellectual and cultural atmosphere.

Ilkka Niiniluoto

Chair of the Local Organising Committee

Plenary Lectures

Logic in Play

Johan van Benthem, Amsterdam, Stanford, and Tsinghua University

Repertoires: How to Transform a Project into a Research Community

Rachel A. Ankeny, University of Adelaide, AUSTRALIA

Sabina Leonelli, University of Exeter, UNITED KINGDOM

Scientific Realism, Models and the Social and Behavioral Sciences

Harold Kincaid, University of Cape Town, SOUTH AFRICA

Cubical homotopy type theory and univalence

Steve Awodey, Carnegie Mellon University, USA

Spacetime Functionalism

Eleanor Knox, King's College, London, UNITED KINGDOM

Models in Geometry and Logic: 1880-1920

Patricia Blanchette, University of Notre Dame, USA

Invited Papers

*A1. Mathematical Logic***Constructing normal numbers**

Verónica Becher, University of Buenos Aires, ARGENTINA

Entanglement and Formalism Freeness: Templates from Logic and Set Theory

Juliette Kennedy, University of Helsinki, FINLAND

Global Reflection Principles

P.D. Welch, School of Mathematics, University of Bristol, UNITED KINGDOM

*A2. Philosophical Logic***Could there be no logic?**

Gillian Russell, Department of Philosophy, Washington University St Louis, UNITED STATES

Logic Revision: Some Formal and Semi-Formal Techniques for Logic Choice

Edwin Mares, Victoria University of Wellington, NEW ZEALAND

A3. Computational Logic and Applications of Logic**Syntactic Epistemic Logic**

Sergei Artemov, City University of New York, USA

A Logical Revolution

Moshe Y. Vardi, Rice University, USA

A4. Invited Session: Historical Aspects of Logic**Intensional logic before Leibniz**

Paul Thom, University of Sydney, AUSTRALIA

B1. Methodology**From nowhere, from here now, or from there then. A tale of success-to-truth inferences along perspectivalist lines.**

Michela Massimi, University of Edinburgh, UNITED KINGDOM

Fact, Fiction, and Finance: Methodological Aspects of Econophysics

Dean Rickles, University of Sydney, AUSTRALIA

B2. Formal Philosophy of Science and Formal Epistemology**Bayesian Philosophy of Science**

Stephan Hartmann, LMU Munich, GERMANY

The credit economy and the economic rationality of science

Kevin Zollman, Carnegie Mellon University, USA

B3. Metaphysical Issues in the Philosophy of Science**What gives Direction to Time?**

Barry Loewer, Rutgers University, USA

On the Prospects of an Effective Metaphysics

Kerry McKenzie, UC San Diego, USA

B4. Ethical and Political Issues in the Philosophy of Science**Rationality at the science-policy interface**

Sven Ove Hansson, KTH Royal Institute of Technology, Stockholm, SWEDEN

Biodiversity and Bio-patenting: Constructive Challenges of Scientific Research

Sang-Wook Yi, Hanyang University, Seoul, SOUTH KOREA

B5. Historical Aspects in the Philosophy of Science**On theories**

William Demopoulos, The University of Western Ontario London, CANADA (presented by Thomas Uebel)

At the Roots of Probabilistic Epistemology

Maria Carla Galavotti, University of Bologna, ITALY

C1. Philosophy of the Formal Sciences**Explanation in Mathematics**

Mark Colyvan, University of Sydney, AUSTRALIA

Three degrees of Imprecise Probability [IP] Theory

Teddy Seidenfeld, Carnegie Mellon University, USA

C2. Philosophy of the Physical Sciences**The quantum origin of statistical-mechanical probability**

David Wallace, University of Oxford, UNITED KINGDOM

C3. Philosophy of the Life Sciences**The Transnational Turn in the History of Science**

Ana Barahona, National Autonomous University of Mexico UNAM, MEXICO

Information and Causation in Biology

Paul E. Griffiths, University of Sydney, AUSTRALIA

C4. Philosophy of the Cognitive and Behavioural Sciences**The Rewards of Associative Modeling**

Cameron Buckner, University of Houston, USA

What is action-oriented perception?

Zoe Drayson, University of Stirling, UNITED KINGDOM

C5. Philosophy of the Humanities and the Social Sciences**Scaffolding and Bootstrapping: How Archaeological Evidence Bites Back**

Alison Wylie, University of Washington, UNITED STATES & Durham University, UNITED KINGDOM

C6. Philosophy of the Applied Sciences and Technology**How to bring philosophy back into science – Epistemological constructivism as a viable picture of science?**

Mieke Boon, University of Twente, The Netherlands

C7. Philosophy of Medicine**Molecular medicine: the clinical method enters the lab. What primary tumor culture teaches us?**

Giovanni Boniolo, University of Milan & IEO, ITALY

C8. Metaphilosophy**Intuition and Replication**

Jennifer Nagel, University of Toronto, CANADA

Joint Commission - International Union of History and Philosophy of Science (IUHPS)**Prospects for an Integrated History and Philosophy of Composition**

Chang Hasok, University of Cambridge, UNITED KINGDOM

CLMPS 2015 conference theme: Models and Modelling**Confirmation Theory for Idealized Models**

Michael Weisberg, University of Pennsylvania, USA

Models and Modelling in Formal Epistemology: Some Thoughts on Probability Aggregation

Eleonora Cresto, University of Buenos Aires & The National Scientific and Technical Research Council, ARGENTINA

Modelling failure

Uskali Mäki, University of Helsinki, FINLAND

International Council for Science (ICSU): Health and Wellbeing in the Changing Urban Environment**Health and Well-Being in the Changing Urban Environment – An interdisciplinary program of the International Council for Science (ICSU)**

Dov Jaron, Drexel University, USA & ICSU, FRANCE

Well-being and Health: A Perspective from Philosophy of Science

Anna Alexandrova, University of Cambridge, UNITED KINGDOM

International Council for Science (ICSU): Future Earth

Transformative Research for a Sustainable Future Earth

Gordon McBean, International Council for Science & Western University, CANADA

Biodiversity and Triage

Mark Colyvan, University of Sydney, AUSTRALIA

Climate Models and Calibration and Confirmation: The Need for a More Nuanced Picture of Use-Novelty and Double-Counting

Charlotte Werndl, London School of Economics, UNITED KINGDOM

Models and Empirical Philosophy: A Session in Honor of Patrick Suppes

Pat Suppes : from logic to probabilistic metaphysics

Anne Fagot-Largeault, The Collège de France, FRANCE

Congress Programme

MONDAY, 3 August	TUESDAY, 4 August	WEDNESDAY, 5 August
9.00-12.00/14.30 Registration Main Building lobby	9.00-10.30 Room 1 Plenary lecture: Rachel Ankeny	9.00-10.30 Great Hall Plenary lecture: Harold Kincaid
	10.30-11.00 Coffee	10.30-11.00 Coffee
	11.00-13.00 Contributed Papers & Symposia	11.00-13.00 Contributed Papers & Symposia
12.00-13.00 Room 1 Models: Weisberg	+A3. Artemov & Vardi +B4. Hansson & Yi	+B2. Hartmann & Zollman + B5. Demopoulos & Galavotti
13.00-14.30 Lunch Main Building	13.00-14.30 Lunch	13.00-14.30 Lunch
14.30-16.30 Opening Ceremony Great Hall	14.30-16.30 Contributed Papers & Symposia +ICSU: Health & Wellbeing: Jaron & Alexandrova	14.30-16.30 Contributed Papers & Symposia +A1. Becher & Kennedy +B3. Loewer & McKenzie
16.30-17.00 Coffee	16.30-17.00 Coffee	16.30-17.00 Coffee
17.00-18.30 Great Hall Plenary lecture: Johan van Benthem	17.00-19.00 Contributed Papers & Symposia + C3. Barahona & Griffiths	17.00-18.30 Contributed Papers +A1. Welch (17.00-18.00)
18.30-20.00 University Reception Great Hall Foyers		18.30-20.00 City Hall Reception
	19.30-21.30 City Visit	

Congress Programme

THURSDAY, 6 August	FRIDAY, 7 August	SATURDAY, 8 August
9.00-10.30 , Pl Plenary lecture Steve Awodey	9.00-10.30 Great Hall Plenary lecture: Eleanor Knox	
10.30-11.00 Coffee	10.30-11.00 Coffee	10.00-12.00 Contributed Papers & Symposia
11.00-13.00 Contributed Papers & Symposia + A2. Mares & Russell + C6. Boon & C7. Boniolo	11.00-13.00 Contributed Papers & Symposia +C4. Buckner & Drayson + B1. Massimi & Rickles	+ Joint Commision: Chang + Session in honor of Suppes
13.00-14.30 Lunch	13.00-14.30 Lunch (+ Executive lunch)	12.00-13.30 Lunch
14.30-16.30 Contributed Papers & Symposia + ICSU: Future Earth: McBean & Colyvan	14.30-16.30 Contributed Papers & Symposia + Models & Modelling Cresto & Mäki	13.30-15.30 Contributed Papers & Symposia +C1: Colyvan & Seidenfeld +C5. Wylie & C8. Nagel
16.30-17.00 Coffee	16.30-17.00 Coffee	15.30-16.00 Coffee
17.00-.19.00 Contributed Papers & Symposia + ICSU: Future Earth: Werndl (17.00-18.00)	17.00-19.00 Contributed Papers & Symposia +C2. Wallace (17.00-18.00) + A4. Thom (17.00-18.00)	16.00-18.00 Great Hall Plenary lecture: Patricia Blanchette + Closing Ceremony
18.00-20.00 DLMPS General Assembly Consistory's Hall	19.30-24.00 Dinner, Restaurant Bank	<i>Scientific Program</i>
		<i>Scientific w. LC 2015</i>
		<i>Social Program</i>
		<i>Social w. LC 2015</i>

