

# Michael T. Stuart

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## ACADEMIC APPOINTMENTS

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- 2016- Postdoctoral Fellow, Centre for Philosophy of Natural and Social Science,  
**London School of Economics and Political Science**  
Project: “Imagination in Science”  
Funder: Social Sciences and Humanities Research Council of Canada
- 2015 Postdoctoral Fellow, Center for Philosophy of Science  
**University of Pittsburgh**

### Visiting Appointments

- 2018 Visiting Scholar, Department of History and Philosophy of Science,  
**University of Cambridge**
- 2013 Visiting Scholar, Department of Philosophy  
**University of Bielefeld**

## EDUCATION

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PhD. Institute for History and Philosophy of Science and Technology (IHPST),  
**University of Toronto** (2015)  
Dissertation Title: “Thought Experiments in Science”  
Committee: James R. Brown, Yiftach Fehige, Joseph Berkovitz, Catherine Elgin

M.A. Department of Philosophy, **York University** (2008)

Honours B.A. in Philosophy (summa cum laude), **York University** (2007)

## RESEARCH AREAS

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**Areas of Specialization:** philosophy of science; epistemology

**Areas of Competency:** history of science; philosophy of mind; experimental philosophy; logic; philosophy of language; metaphysics

## PUBLICATIONS

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### Peer Reviewed Publications

- Forthcoming “The Role of Imagination in Social Scientific Discovery: Why Machine Discoverers Will Need Imagination Algorithms.” In M. Addis et al. (eds.), *Scientific Discovery in the Social Sciences*. Springer Synthese Library.

- Forthcoming “The Content-Dependence of Imaginative Resistance.” In F. Cova and S. Rénhault (eds.), *Advances in Experimental Philosophy of Aesthetics* (with H. Kim and M. Kneer). London: Bloomsbury.
- 2018 “How Thought Experiments Increase Understanding.” Pp. 526-44 in M. Stuart et al. (eds.), *The Routledge Companion to Thought Experiments*. London: Routledge.
- 2018 “Thought Experiments: The State of the Art.” Pp. 1-28 in M. Stuart et al. (eds.), *The Routledge Companion to Thought Experiments*. London: Routledge.
- 2017 “Imagination: A Sine Qua Non of Science.” *Croatian Journal of Philosophy* Vol. XVII, No. 49: 9-32.
- 2016 “Norton and the Logic of Thought Experiments.” *Epistemologia* 26: 451–466.
- 2016 “Taming Theory with Thought Experiments: Understanding and Scientific Progress.” *Studies in the History and Philosophy of Science* 58: 24-33.
- 2015 “Philosophical Conceptual Analysis as an Experimental Method.” Pp. 267-292 in Gamerschlag et al. (eds.). *Meaning, Frames and Conceptual Representation*. Düsseldorf: Düsseldorf University Press.
- 2014 “Cognitive Science and Thought Experiments: A Refutation of Paul Thagard’s Skepticism.” *Perspectives on Science* 22: 98-121.
- 2014 “On the Origins of the Philosophy of Thought Experiments: The Forerun.” *Perspectives on Science* 22: 13-54 (with Y. Fehige).
- 2014 “Introduction to the Special Issue on Thought Experiments.” *Perspectives on Science* 22: 1-12 (with Y. Fehige).

### **Edited Volumes**

- 2018 *The Routledge Companion to Thought Experiments*. London: Routledge (with Yiftach Fehige and James R. Brown).
- 2014 *Thought Experiments*, special issue of *Perspectives on Science* 22:2 (with Y. Fehige).

### **Manuscripts in Preparation**

- Submitted “Epistemology of Scientific Imagination: A Dual Process Model.”
- In Preparation “What Scientists tell us about the Imagination” (with Nancy Nersessian)
- In Preparation “The Pragmatics of Scientific Representation: An In Vivo Study of Scientific Modelling” (with Nancy Nersessian)

- In Preparation “Looking Inside the Black Box: A New Kind of Scientific Visualization” (with Nancy Nersessian)
- In Preparation “Empirically Disambiguating Imagination and Supposition” (with Markus Kneer)
- In Preparation “The Value Free Ideal as an Imaginary Model of Science” (with Philip Thonemann)
- In Preparation “P-hacking in Experimental Philosophy” (with Edouard Machery and David Colaço)

### **Book Reviews**

- 2013 “*Thought Experiments in Methodological and Historical Contexts* edited by Katerina Ierodiakonou and Sophie Roux.” *HOPOS: The Journal of the International Society for the History of Philosophy of Science* 3: 154-57 (with J. Brown).
- 2012 “*Laboratory of the Mind* by James R. Brown.” *Spontaneous Generations: A Journal for the History and Philosophy of Science* 6: 237-241.

### **Public Philosophy**

- Forthcoming Post for *Auxiliary Hypotheses*, a blog by the British Society for the Philosophy of Science.
- 2017 “Using Imagination to Empathize with Space Robots, Demons, and Other Weird Stuff.” *The Junkyard of the Mind*, a blog on the imagination curated by Amy Kind of Claremont McKenna College.
- 2015 “Better Science Policy in Canada.” *The Bubble Chamber*, a blog on the history and philosophy of science.

### **FELLOWSHIPS, GRANTS, AND AWARDS**

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#### **Fellowships**

- 2016-2018 Social Sciences and Humanities Research Council of Canada Postdoctoral Fellowship (\$81 000)
- 2015 Postdoctoral Fellowship, University of Pittsburgh (\$54 830)
- 2009-2014 University of Toronto Fellowship (\$112 000)
- 2013-2014 Ontario Graduate Scholarship (\$15 000)
- 2012-2013 Ontario Graduate Scholarship (\$15 000)

2008 York University Graduate Scholarships (\$4000)

### **Grants**

2017 Aristotelian Society Conference Grant (\$530)

2017 Mind Association Major Conference Grant (\$2 305)

2017 British Society of Aesthetics Small Conference Grant (\$2 595)

2013 School of Graduate Studies Research Travel Grant (\$3 250)

2013 Visiting scholar at University of Bielefeld, Department of Philosophy, Faculty of Arts and Science Student Award: Germany/Europe Research Fund (\$2 760)

2006 Ontario Student Opportunity Grant (\$3 886)

### **Awards**

2015 IHPST Travel Award (\$1 500)

2014 IHPST Travel Award (\$1 500)

2014 University of Toronto Doctoral Completion Award (\$15 718)

2013-2014 University of Toronto Faculty of Arts and Science Conference Fund (\$500)

2013 IHPST Travel Award (\$1 300)

2008 Elizabeth Bentham Prize for highest mark in Theoretical Philosophy Exam, York University (\$500)

## **CONFERENCES AND PRESENTATIONS**

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### **Invited Presentations**

2018 “The Value-free Ideal as an Imaginary Model of Science.” Philosophy of Science Conference. Inter-University Centre, Dubrovnik, April 16-20.

2018 “Imagination and Narrative in Science.” Narrative Science Research Group, London School of Economics. March 13.

2018 “A Framework for Doing Epistemology of (Scientific) Imagination.” Leeds HPS seminar. March 7.

2018 “How Scientists Use Imagination to Learn about the World.” Lecture for the Royal Institute of Philosophy. St. Mary’s University. February 27.

- 2017 “A New Kind of Scientific Visualization: Taking Snapshots from inside the Black Box.” Lebanese American University, November 24.
- 2017 “A Different Use for Scientific Thought Experiments.” Aarhus philosophy colloquium. November 8.
- 2017 “Epistemology in Two Minds: Should we Bother with a Dual Systems Account of Imagination?” Imagination and Knowledge Workshop. University of Konstanz, September 28-29.
- 2017 “Desiderata for Epistemic Representations: Results from an Ethnographic Study of a Computational Systems Biology Lab.” UK Integrated HPS workshop, Nottingham, June 22.
- 2017 “Thought Experiments and Computer Simulations are Metaphorical Experiments.” Conference on Simulation and Thought Experiments. University of Geneva, June 8-9.
- 2017 “‘A Diagram Is a [Computer] Model’: Imagination as a Mediator between Visual and Formal. Imagination in Science Conference. University of Leeds, June 6.
- 2017 “An Account of Imagination for Epistemology of Thought Experiments.” Philosophy of Science Conference. Inter-University Centre, Dubrovnik, April 24-28.
- 2017 “Imagining Our Way to Three Kinds of Understanding.” University of Iceland, March 8.
- 2017 “A Dual Systems Account of Scientific Imagination.” Centre for Philosophy of Natural and Social Science, London School of Economics, February 6.
- 2016 “To Formal Models and Back Again.” University of Macerata, October 18.
- 2015 “The Epistemology of the Imagination.” University of Pittsburgh, September 29.
- 2015 “Subjective Elements of Scientific Representation: Empathizing with Black Holes.” Philosophy of Science Conference. Inter-University Centre, Dubrovnik, April 13-17.
- 2015 “Empathy and the Scientific Method.” University of Waterloo, Canada. March 4.
- 2014 “Evolutionary Theory, Causal Completeness, and Theism – Eliot Sober and ‘Guided’ Mutation.” University of Toronto, Canada, April 22.
- 2014 “Imagination: A Sine Qua Non of Science.” Philosophy of Science Conference. Inter-University Centre, Croatia, April 16.

- 2013 “A New Role for Thought Experiments.” Konstanz University, Germany, June 14.
- 2013 “Thought Experiments, Kant, and Theory Proliferation.” University of Bielefeld, Germany, June 11.
- 2013 “A Solution to the Problem of Coordination.” University of Bonn, Germany, May 28.
- 2013 “Thought Experiments and the Connection between Theory and Experience.” University of Macerata, Italy, May 8.
- 2012 “Paul Thagard: A Refutation.” Thought Experiments in Science: Four Blind Spots - An International Workshop. University of Toronto, Canada, March 23.

### **Refereed Conference Presentations**

- 2018 “Mental Models, Scientific Imagination and Epistemological Anarchy.” Philosophy of Science Association, Seattle, November 1-4.
- 2018 “The Content-Dependence of Imaginative Resistance.” Philosophy of Imagination Conference, Ruhr-Bochum, March 15-16.
- 2017 “A Framework for Epistemology of the Imagination.” Nordic Network for Philosophy of Science, Copenhagen, April 20-21.
- 2016 “Empirical Philosophy of Imagination.” Evidence and Imagination. Graz, November 3-5.
- 2016 “Imagination in the Lab.” Quadrennial Fellows Conference of the Center for Philosophy of Science. Lund University, Lund, July 11-13.
- 2016 “Scientific Understanding and the Role of Imagination.” Summer Seminar on Understanding, part of the Capstone Conference for the Varieties of the Understanding Project. Fordham University, June 20-25.
- 2016 “Scientists’ Attitudes toward Imagination.” Society for the Philosophy of Science in Practice (SPSP). Rowan University, Glasboro, June 17-19.
- 2016 “Some Empirical Constraints on the Epistemology of Imagination.” Mind and Brain Conference. New College of the Humanities, London, March 25-26.
- 2016 “Empirically Disambiguating Imagination from Supposition.” Southern Society for Philosophy and Psychology. Louisville, KY, March 10-12.
- 2015 “Imagination in Social Scientific Discovery.” Conference on Scientific Discovery in the Social Sciences. London School of Economics and Political Science, UK, Jan 30-31.

- 2012 “The Cognitive Science of Thought Experiments: Paul Thagard's Skepticism.” The Canadian Society for the History and Philosophy of Science. University of Waterloo, Canada, May 26-29.
- 2011 “Can Bayesian Network Modeling Solve Problems in the Philosophy of Science?” 14th Congress of Logic, Methodology and Philosophy of Science. Nancy University, France, July 19-26.
- 2011 “What Can Philosophy Learn from the Clock-in-the-Box Thought Experiment?” The Canadian Society for the History and Philosophy of Science. University of New Brunswick, Canada, May 29-31.
- 2011 “The Notion of a ‘Very Generalized Logic’ in Thought Experiments.” Philosophy of Science Colloquium. University of Johannesburg, South Africa, January 18.
- 2010 “Thought Experiments: Arguing with John Norton.” Australasian Association of Philosophy Conference. University of Waikato, New Zealand, December 5–9.
- 2010 “The Role of Henri Poincaré and Pierre Duhem in the Establishment of Conventionalism in Modern Philosophy of Science.” History of the Philosophy of Science Conference at the Central European University. Budapest, Hungary, June 24-27.
- 2010 “The Role of Henri Poincaré and Pierre Duhem in the Establishment of Conventionalism in Modern Philosophy of Science.” The Canadian Society for the History and Philosophy of Science. Concordia University, Canada, May 28-31.
- 2009 “Philosophical Conceptual Analysis: The Move from Use to Meaning.” Second Conference on Concept Types and Frames in Language, Cognition, and Science. Heinrich Heine University, Germany, August 24-26.
- 2009 “Charity as a Bridge from Use to Meaning.” University of Western Interdisciplinary Student Symposium on Language Research. University of Western Ontario, Canada, March 6-7.

## **TEACHING EXPERIENCE**

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### **University of Toronto, Co-Instructor**

Natural Science and Social Issues, University of Toronto (2014-2015)

### **University of Toronto, Sole Instructor**

Scientific Revolutions I (2013-2014)

### **University of Toronto, Teaching Assistant**

Natural Science and Social Issues (2013-2014)

Reason and Truth (2013-2014)  
History of Evolutionary Biology (2013-2014)  
Symbolic Logic I (2013-2014)  
Modern Symbolic Logic (2012-2013)  
Scientific Revolutions II (2012-2013)  
Introduction to Philosophy (2012-2013)  
Modern Symbolic Logic (2012-2013)  
Scientific Revolutions II (2012-2013)  
Introductory Philosophy of Science (2011-2012)  
Introduction to Philosophy (2011-2012)  
Modern Symbolic Logic (2011-2012)  
Scientific Revolutions I (2010-2011)

**York University, Teaching Assistant**

Introduction to Philosophy (2008-2009)

**PROFESSIONAL SERVICE**

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**Referee**

*Philosophy of Science*  
*The British Journal for the Philosophy of Science*  
*European Journal for Philosophy of Science*  
*Synthese*  
*Studies in the History and Philosophy of Science*  
*Springer Monographs*  
*Dialectica*  
*TOPOI*  
*Epistemologia*  
*Canadian Philosophical Association*  
*Philosophical Papers.*

**Panels, Conferences, and Events Organized**

Co-organizer, “Bridging the gap: Scientific Imagination meets Aesthetic Imagination”  
(October 2017)

Co-organizer, “(Re)Engineering Biology: The Emerging Engineering Paradigm in  
Biomedical Engineering, Systems Biology, and Synthetic Biology” (April  
2016)

Co-organizer, “Better Science Policy in Canada” (January 2015)

Co-organizer, Philosophy of Science Speaker Series (2013)

Co-organizer, Consortium for the History and Philosophy of Biology (May 2010)



Co-organizer, “150 Years After Origin: Biological, Historical and Philosophical Perspectives” (November 2009)

Conference Committee, Second Annual Graduate Philosophy Conference (June 2009)

### **Laboratory Work**

Lab consultant: Susan Carey’s lab (Harvard, Department of Psychology) on thought experiments (2015-2016)

Lab member: Edouard Machery’s lab (University of Pittsburgh) on experimental philosophy (2015-2016)

### **Technical Proficiency**

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HTML  
QDA miner  
MaxQDA  
Qualtrics

### **Public Outreach**

University of Toronto Museum of Scientific Instruments exhibit (November 2008)

### **Languages**

English (native)  
Spanish (fluent)  
French (conversational, reading and writing)  
German (reading)  
Punjabi (basic oral proficiency)

### **ACADEMIC REFERENCES**

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Roman Frigg (r.p.frigg@lse.ac.uk)  
Professor and Director of the Centre for Philosophy of Natural and Social Science  
Department of Philosophy, Logic and Scientific Method  
London School of Economics and Political Science  
Houghton Street, London, UK, WC2A 2AE

Nancy J. Nersessian (nancy.nersessian@gmail.com)  
Professor  
Georgia Tech Regents' Professor of Cognitive Science (Emerita)  
Harvard Research Associate  
Department of Psychology, Harvard University  
William James Hall 33 Kirkland St.  
Cambridge, MA, USA, 02138

James Robert Brown (jrbrown@chass.utoronto.ca)  
Professor  
Department of Philosophy  
University of Toronto  
170 St. George Street, Rm. 514  
Toronto, Ontario, Canada  
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Yiftach Fehige (yiftach.fehige@utoronto.ca)  
Associate Professor  
Institute for the History and Philosophy of Science and Technology  
University of Toronto  
91 Charles Street West  
Toronto, Ontario, Canada  
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## DISSERTATION ABSTRACT

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### Thought Experiments in Science

Thought experiments are a means of imaginative reasoning with an employment record longer than two and a half thousand years. Used by Aristotle, Galileo, Newton, Darwin, Maxwell, and Einstein, they form part of the education of every scientist alive today.

While most scientific instruments aim to increase the precision of our interaction with empirical data, thought experiments leave the empirical realm behind. They spin buckets in an empty universe, summon demons to play with particles, and challenge us to throw spears at the edge of space. If tools of the imagination like thought experiments are important in science, what role are they playing? Are they for exploring possibilities, gaining knowledge, communicating ideas, or something else?

Using the methods of history, philosophy and cognitive science, I argue that while thought experiments do not usually discover or justify new facts or hence provide new knowledge, they do often increase the empirical content of theoretical structures (laws, models, concepts, etc.) for an agent. Empirical content is increased when the agent connects a theoretical structure to existing concepts, experiences, values and abilities. Through these connections, thought experiments increase scientific understanding. Knowledge can be produced when understanding is applied, but this is a separate achievement. I argue that the understanding produced by thought experiments is necessary for scientific progress because without grasping the empirical content of theoretical structures, those structures cannot be used, and it is necessary for science that they be used. This doesn't mean thought experiments are necessary: only the understanding they produce is. But sometimes that understanding is best arrived at by the use of thought experiments (and imagination more generally).

Chapter 1 introduces the philosophical literature on thought experiments. Chapters 2-4 reject two important accounts of thought experiments: one that portrays thought experiments as mere logical arguments, and another that uses cognitive scientific evidence to argue that thought experiments are misleading and dangerous. Chapter 5 examines five important historical cases and reveals that their central aim is to increase understanding instead of knowledge. This goes against almost three decades of thinking about thought experiments that portrays them as tools to increase knowledge. Chapter 6 considers results in cognitive and social science to explain the kind of understanding produced, how it is produced, and why it is important. Chapter 7 grounds the ability to increase understanding (in the sense of increasing empirical content) in the use of human imagination. Imagination can be understood in two senses. In one, it is the ability to leave reality behind. Imagination in this sense cannot be investigated a priori or a posteriori without invoking it, making every investigation of it circular. The other sense of imagination is specific applications of the ability to imagine. These applications can be investigated non-circularly, and we can discern their epistemic value in each case. I conclude by exploring some implications of this argument for the relationships among imagination, understanding, explanation, knowledge, representation and objectivity.