

DOUGLAS BLUE

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ACADEMIC RECORD

PhD in Philosophy, Harvard University	<i>Expected 2023</i>
Visiting student, UC Berkeley Group in Logic & Methodology of Science	<i>2017-18</i>
MA in Logic and Philosophy of Science, LMU Munich	<i>2015</i>
BA in Philosophy, UC Berkeley	<i>2013</i>

AREAS OF SPECIALIZATION

Logic, set theory (determinacy, inner models and large cardinals), philosophy of mathematics, history of analytic philosophy.

AREAS OF COMPETENCE

Philosophy of language/logic/mind/science, early modern philosophy.

PAPERS

Provably Δ_1 games (with Juan Aguilera). *Journal of Symbolic Logic*, 85(3), 1124-1146.
What bears on what? Chance & the continuum hypothesis. *Under review*.
Infinite inference. *Under review*.

DRAFTS IN PROGRESS

Axiom acceleration. *Draft available*.
Relativism in mathematics. *In preparation*.
Self-iterability and Usuba's theorem. *In preparation*.
Very large cardinals and the Ultimate L conjecture. *In preparation*.

THESIS

Determinacy, Sealing, and the Inner Model Problem

Committee: Peter Koellner, W. Hugh Woodin (Chair)

David Hilbert claimed that in mathematics “there is no *ignorabimus*,” no problem which is beyond our ken to solve. However, many of the central problems of mathematics were subsequently shown to be unsolvable using the standard axioms of mathematics. My dissertation suggests that Hilbert’s vision can be borne out—using new axioms—for a significant part of mathematics. I show that under certain conditions one of the key approaches to solving unsolvable problems may be undermined. I also prove theorems on the very tenability of these conditions. Furthermore, I obtain results which suggest that the currently unsolvable problem of how many real numbers there are may admit a definitive solution.

AWARDS

Dissertation Completion Fellowship, Harvard University Graduate School of Arts & Sciences	2022–23
Merit Fellowship, Harvard University Graduate School of Arts & Sciences	2020
GSC Travel Grant, Harvard University	2019
Certificate of Distinction and Excellence in Teaching, Harvard University (x9)	
• Logic and Philosophy	Spring 2022
• Frege, Russell and the Early Wittgenstein	Spring 2022
• The Philosophy of J. L. Austin	Fall 2021
• The Power and Limits of Logic	Fall 2021
• Later Wittgenstein	Spring 2020
• Fundamentals of Logic	Fall 2019, Spring 2021
• Logical Empiricism	Fall 2019
• Philosophy of Mind	Spring 2019
Merit Scholarship, Munich Center for Mathematical Philosophy	2013–15

TALKS

(* indicates the talk was invited)

*TBD,

AMS Special Session on Large Cardinals and Forcing Axioms, University of Virginia 11 March 2022

“The generic multiverse is not going away,”

Set Theory: Bridging Mathematics and Philosophy, University of Konstanz 31 July 2019

Harvard Graduate Workshop in Metaphysics & Epistemology Fall 2018

Logic group workshop, University of Haifa 11 June 2018

“The most impure proofs,”

Mathematics in Philosophy: Purity and Idealization:

A conference in honor of Mic Detlefsen, University of Notre Dame 23 March 2019

“Is $V=Ultimate\ L?$ ”

Midwest Philosophy of Mathematics Workshop 19, University of Notre Dame 27 October 2018

“Instrumentalism about infinite number in Leibniz,”

Leibniz Society of North America Congress, University of Montreal 12 October 2018

International Early Modern Workshop, Harvard University 30 September 2018

*“Berkeley cardinals,”

Student Logic Colloquium, UC Berkeley 6 April 2018

*“Embeddings into the Turing degrees,”

Recursion Theory Seminar, UC Berkeley 19 March 2018

*“The difficulties of \square_κ in long extender models,”

4th Münster conference on inner model theory, WWU Münster 27 July 2017

“Proofs and strategies: meaning as use and recursive enumerability,”

2nd Philosophy Graduate Conference, National Autonomous University of Mexico March 2016

“The interdependence of *a priori* and *a posteriori* in the search for new axioms,”

Graduate conference on *A Priority*, University of Connecticut February 2016

“Forcing Axioms and Maximality as the Demand for Interpretability,”

Symposium on the Foundations of Mathematics III, Kurt Gödel Research Center September 2015

DEPARTMENTAL

“The extent of generic absoluteness,” Harvard Graduate Workshop in Metaphysics & Epistemology	<i>Spring 2020</i>
“The extender algebra,” Harvard Logic Seminar	<i>2 October 2019</i>
“Equivalence relations and effective cardinality,” Harvard Logic Seminar	<i>8 April 2019</i>
“What the generic multiverse should be like (but cannot be)” Harvard Graduate Workshop in Metaphysics & Epistemology	<i>Spring 2019</i>
“Sacks’ embedding problem for the arithmetic degrees,” Harvard Logic Seminar	<i>29 October 2018</i>
“Expressive power in mathematics & the Turing degrees” Harvard Graduate Workshop in Metaphysics & Epistemology	<i>Fall 2018</i>

TEACHING

BRANDEIS UNIVERSITY (AS INSTRUCTOR OF RECORD)

Mathematical Logic (Incompleteness)	<i>Spring 2021</i>
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HARVARD COLLEGE (AS INSTRUCTOR OF RECORD)

The Philosophy of J. L. Austin	<i>Fall 2021</i>
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Reverse Mathematics	<i>Spring 2021</i>
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Introduction to Logic (Harvard Summer School)	<i>Summer 2020</i>
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Logical Empiricism	<i>Fall 2019</i>
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HARVARD COLLEGE (AS TEACHING FELLOW)

Frege, Russell and the Early Wittgenstein, for Warren Goldfarb	<i>Spring 2022</i>
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Logic and Philosophy, for Warren Goldfarb	<i>Spring 2022</i>
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The Power and Limits of Logic, for Mark Richard	<i>Fall 2021</i>
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Rawls and Liberal Political Philosophy, for Emilio Mora	<i>Spring 2020</i>
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Later Wittgenstein, for Warren Goldfarb	<i>Spring 2020</i>
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Fundamentals of Logic (Completeness), for W. Hugh Woodin	<i>Spring 2021, Fall 2019</i>
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Philosophy of Mind, for Cheryl Chen	<i>Spring 2019</i>
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The History of Modern Moral Philosophy, for Christine Korsgaard	<i>Fall 2018</i>
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UC BERKELEY (AS GRADUATE STUDENT INSTRUCTOR)

Introduction to Logic, for Wes Holliday	<i>Summer 2019, 2018</i>
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Introduction to Logic, for Daniel Warren	<i>Spring 2018</i>
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MISC. TEACHING, ETC.

HARVARD COLLEGE PROGRAM FOR RESEARCH IN SCIENCE AND ENGINEERING

Project on Kaplansky’s conjecture	<i>Summer 2020</i>
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DIRECTED READING PROJECTS, HARVARD COLLEGE

Philosophy, model theory	<i>Fall 2021</i>
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Philosophy, skepticism & early analytic philosophy	<i>Fall 2020</i>
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Philosophy, model theory and its philosophy	<i>Fall 2020</i>
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Mathematics, set theory through the relative consistency of CH	<i>Spring 2020</i>
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HARVARD COLLEGE

Research assistant for Privacy, Security, Connectivity
Logic tutor
Grader for Philosophy of Mind, for Cheryl Chen

Fall 2022
Spring 2022
Spring 2020

SERVICE

DEPARTMENTAL SERVICE

Graduate Student Representative *2019-20*
Metaphysics & Epistemology workshop coordinator *Spring 2019*

REFEREEING

Review of Symbolic Logic, Journal of Mathematical Logic

ORGANIZATION

Recursion Theory Seminar, Harvard University *Fall 2018*

GRADUATE COURSEWORK

(* indicates an audit)

HARVARD UNIVERSITY

The HOD Analysis, Peter Koellner
Topics in Invariant Descriptive Set Theory, Assaf Shani
Topics in Set Theory and Mathematical Logic: Definable equivalence relations, Assaf Shani
**Topics in Wittgenstein*, Warren Goldfarb (multiple times)
**Ordinary Language Philosophy*, Warren Goldfarb
Aristotle against the Atomists, Jacob Rosen
From Frege to Gödel, Warren Goldfarb
Topics in Philosophy of Mathematics, W. Hugh Woodin
Hume's Ethical Theory, Christine Korsgaard
The Rationalists, Jeffrey McDonough
Topics in Set Theory, W. Hugh Woodin (multiple times)
First Year Colloquium: Ethics, Selim Berker
Topics in Political Philosophy, T.M. Scanlon
Quine, Warren Goldfarb
Topics in Model Theory: Classification Theory, William Boney
**Frege, Russell, and the Early Wittgenstein*, Warren Goldfarb
Topics in the Philosophy of Mathematics: the a priori, Peter Koellner
First Year Colloquium: Metaphysics & Epistemology, Susanna Rinard & Susanna Siegel
Descriptive Set Theory, Peter Koellner
Topics in Model Theory: Stability Theory, William Boney

TUFTS UNIVERSITY

**Science before Newton*, George Smith (multiple times)
**Newton's Principia*, George Smith (multiple times)

UC BERKELEY

Set theory seminar, John Steel (multiple times)
Recursion theory seminar, Antonio Montalban
Recursion theory seminar, Ted Slaman
Kant's Metaphysical Foundations of Natural Science, Daniel Warren

LMU MUNICH

Central Topics in Philosophical Logic I, Hannes Leitgeb
Formal Methods II: Models and Simulations, Gregory Wheeler
Set Theory (Directed Reading), Conor Mayo-Wilson
Science without Truth, Karim Thebault
Hilbert, Gödel, Gentzen, Martin Fischer
Central Topics in Philosophy of Science II, Stephan Hartmann
Reasoning, Stephan Hartmann
Philosophy of Statistics, Conor Mayo-Wilson
Central Topics in Philosophical Logic II, Hannes Leitgeb
Provability and Its Logic, Johannes Stern
Central Topics in Philosophy of Science I, Stephan Hartmann
Philosophy of Logic, Ole Hjortland
Proofs and Decisions in Modal Logic, Norbert Gratzl
Philosophy of Quantum Computing, Michael Cuffaro

REFERENCES

Warren Goldfarb
Walter Beverly Pearson Professor of Modern Mathematics and Mathematical Logic
Harvard University
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Peter Koellner
Professor of Philosophy
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W. Hugh Woodin
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Dissertation Summary, *Determinacy, Sealing, and the Inner Model Problem.*

David Hilbert claimed that in mathematics “there is no *ignorabimus*,” no problem which is beyond our ken to solve. However, many of the central problems of mathematics have subsequently been shown to be unsolvable using the standard axiomatization of mathematics. This raises the question whether there are ignorabimuses, or whether there is a way of discovering principles which bear out Hilbert’s vision. My dissertation suggests that Hilbert’s vision can be borne out for a significant part of mathematics.

Prospective ignorabimuses arise in the infinite, but infinity also hands us ways of solving some of them. Logicians began studying *strong axioms of infinity*, principles which assert the existence of sets so large that they can neither be proved nor refuted to exist in the standard axiomatization, and used them to solve some of the ‘unsolvable’ problems. For many mathematicians, these applications of strong axioms are the definitive solutions to those problems. But there are two complications. First, the standard axiomatization cannot prove that strong axioms of infinity are consistent. What grounds do we have for believing them to be? Second, despite their successes—strong axioms of infinity make us ‘omniscient’ with respect to a large class of mathematical propositions—the currently known strong axioms of infinity cannot settle the question *How many real numbers are there?* Are there stronger principles which do?

The consistency of strong axioms is addressed by *inner model theory*. The inner model theory for a strong axiom of infinity shows what the entire mathematical domain must look like assuming that axiom holds. Inner models are paradises of understanding, for their theories are *effectively complete*: we are omniscient with respect to any natural question about an inner model’s internal structure. If a given strong axiom of infinity is inconsistent, that inconsistency should be reflected in its lack of inner model theory. So if a strong axiom of infinity admits an inner model theory, we have reason to believe it is consistent. But developing an inner model theory becomes increasingly intractable as one ascends the hierarchy of increasingly powerful strong axioms of infinity, and to date the most advanced inner model theory covers a modest initial segment of the hierarchy. The *Inner Model Problem* is to extend inner model theory to all strong axioms.

Since strong axioms of infinity do not settle how many real numbers there are, how can we approach the problem? Is there a set of axioms which rules out the possibility of ignorabimuses in the class of propositions unsolved by strong axioms of infinity? If a theory enables us to be omniscient about a class of propositions, it is Ω -complete for that class in the strong logic called Ω -logic. Strong axioms of infinity are thus Ω -complete for the class of propositions they solve. To settle how many real numbers there are, one would like to lift the restricted Ω -completeness provided by strong axioms of infinity to larger classes of propositions.

In my dissertation, I show how, if Ω -completeness extends to certain classes of propositions—so-called *Sealing* scenarios—then we undermine any further progress in inner model theory, our approach to the question of the consistency of strong axioms of infinity. That is, if Ω -completeness holds for certain classes of propositions assuming reasonable hypotheses, then the Inner Model Problem has no solution, at least using the current methods for developing inner model theory. In these Sealing scenarios, we’d have an ‘answer’ to how many real numbers there are, but we would have no reason to believe in the consistency of the principles used to derive it. I also extend Ω -completeness to a new class of propositions, and I prove theorems which suggest that inner model theory can be developed past its current bound and which bear on the compatibility of principles in the literature which decide how many real numbers there are.

The picture that emerges from my work suggests that—for a significant fragment of the infinite at least—Hilbert’s vision may be borne out.