

# DOUGLAS MARSHALL

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## Education

Harvard University, Ph.D. candidate in Philosophy, Ph.D. expected 2010

Harvard University, M.A. Philosophy, 2004

M. A. Thesis: *Deduction and the Uses of Experiment in Descartes' Natural Philosophy*

Advisor: Alison Simmons

Williams College, B.A. Philosophy and Mathematics, *summa cum laude*, 2000

Honors Thesis: *Mathematical Fictionalism*

Advisor: Bojana Mladenović

## Areas of Specialization

Philosophy of Mathematics and Science, Early Modern Philosophy

## Areas of Competence

Logic (through the incompleteness theorems), Metaphysics, Kant, Early Analytic Philosophy, History of the Physical Sciences

## Dissertation

Title: *Investigations into the Applicability of Geometry*

Abstract: Philosophical reflection about the sciences has persistently given rise to worries that mathematics, while true of its own special objects, is inapplicable “to nature” or “to the physical world”. I consider the special case of geometry and begin with worries about the applicability of geometry articulated by Aristotle. I argue that while Aristotle endorsed the use of geometry in the study of nature, even offering a theory of that use, elements of his thought provided the materials for objections to geometry which endured into the 17<sup>th</sup> century. I then examine how Galileo and Leibniz, two preeminent 17<sup>th</sup> century proponents of the new mathematical physics, further developed the objections to geometry and argued we can overcome them.

Committee: Charles Parsons (Chair), Ned Hall, Jeffrey McDonough

## Awards

2002-03 Martin Fellowship, Harvard Philosophy Department

2000 Phi Beta Kappa

2000 Goldberg Prize for best mathematics colloquium given by a graduating senior to the Williams mathematics dept. (topic: many-valued propositional logics), Williams College

## Presentations

“Challenging the Applicability of Geometry”

Harvard Metaphysics and Epistemology Workshop (Spring 2009)

“Leibniz on the Applicability of Mathematical Laws Despite the Unreality of Mathematical Objects”

Harvard Metaphysics and Epistemology Workshop (Fall 2008)

“The Contributions of Mathematical Theories in their Applications”

Harvard Metaphysics and Epistemology Workshop (Spring 2008)

“What is an Application of a Mathematical Theory?”

Harvard Metaphysics and Epistemology Workshop (Fall 2007)

“The Problems of the Applicability of Mathematics”

Pitt Summer Workshop in Philosophy of Mathematics (Summer 2005)

“Deduction and the Uses of Experiment in Descartes’ Natural Philosophy”

Harvard-MIT Metaphysics and Epistemology Reading Group (Spring 2004)

## Graduate Coursework (audited courses marked with an asterisk)

### History and Philosophy of Mathematics and Science:

Philosophy of Mathematics: Parsons’ Structuralism MS (Charles Parsons)

Philosophy of Mathematics: History of Structuralism\* (Charles Parsons)

Philosophy of Mathematics (Stephen Yablo, MIT)

Mathematical Realism\* (Vann McGee, MIT)

Frege’s Philosophy of Mathematics\* (Richard Heck)

Kant’s Philosophy of Mathematics\* (Daniel Sutherland)

History of Ancient Science (John Murdoch)

Archimedes\* (Mark Schiefsky, Barry Mazur, John Murdoch)

Science Before Newton, 1600 – 1684\* (George Smith, Tufts University)

Newton’s *Principia Mathematica*\* (George Smith, Tufts University)

History of Philosophy:

Aristotle's *Posterior Analytics* (Gisela Striker)  
The Continental Rationalists (Alison Simmons)  
Introduction to Kant's *Critique of Pure Reason* (Paul Guyer)  
Kant's *Critique of Pure Reason* (Charles Parsons)  
Quine (Peter Hylton)  
The Philosophies of Rudolf Carnap and W.V. Quine\* (Warren Goldfarb)  
Leibniz\* (Donald Rutherford)  
Leibniz\* (Samuel Levey)

Logic, Metaphysics and Epistemology:

Logic & Philosophy (Warren Goldfarb)  
Theories of Truth (Richard Heck)  
Realism & Anti-Realism (Thomas Scanlon)  
Philosophical Theories of Color (Jim Pryor, Alison Simmons)

Ethics and Practical Reason:

The Theory of Action (Richard Moran)  
Morality and Action (Thomas Scanlon)  
Kant's Ethical Theory (Christine Korsgaard)

**Teaching Experience**

As the main instructor at Harvard University:

Kuhn and Scientific Rationality, Spring 2007 – An undergraduate seminar on Kuhn's *The Copernican Revolution* and *Structure of Scientific Revolutions*, the interaction of philosophical and historical considerations, and scientific realism

As a teaching assistant at Harvard University:

Logic & Philosophy (Peter Koellner), Spring 2004 – incompleteness of arithmetic, computability theory, the Tarskian theory of truth

Introduction to Early Modern Philosophy (Alison Simmons), Spring 2006 – an introductory survey of the works of Descartes, Locke, Hume, and Kant

Metaphysics (Ned Hall), Fall 2005 – universals, modality, laws of nature, free will

Aristotle's *Metaphysics* and Epistemology (Gisela Striker), Fall 2008 – readings from the *Categories*, *Posterior Analytics*, *Physics*, *De Anima*, and *Metaphysics*

As a teaching assistant at Williams College:

Introductory Logic (William Dudley), Spring 1999 – propositional and predicate logic

### **Languages**

Native: English

Extensive speaking, reading, and writing abilities: German, Spanish

Some reading knowledge: French, Italian, Latin

### **Academic Service**

2005-06: Graduate student representative to the Harvard philosophy department faculty

2003-05: Co-organizer of the Harvard-MIT Metaphysics and Epistemology Reading Group

2002-03: Co-organizer of the Harvard-MIT graduate philosophy conference

### **References from the Harvard Philosophy Department**

Charles Parsons: [parsons2@fas.harvard.edu](mailto:parsons2@fas.harvard.edu)

Ned Hall: [ehall@fas.harvard.edu](mailto:ehall@fas.harvard.edu) (also for teaching)

Jeffrey McDonough: [jkmcdon@fas.harvard.edu](mailto:jkmcdon@fas.harvard.edu)

Peter Godfrey-Smith: [pgs@fas.harvard.edu](mailto:pgs@fas.harvard.edu)

Gisela Striker: [striker@fas.harvard.edu](mailto:striker@fas.harvard.edu) (also for teaching)

## Dissertation Abstract

Title: *Investigations into the Applicability of Geometry*

Philosophical reflection about the sciences has persistently given rise to worries that mathematics, while true of its own special objects, is inapplicable “to nature” or “to the physical world”. In my dissertation I aim to achieve conceptual clarity with respect to a family of objections which may plausibly be raised against the applicability of mathematics, putting a special focus on the case of geometry. To that end I examine the views of Aristotle, Galileo, and Leibniz, considering the ways in which the applicability of geometry poses problems for them and also their solutions to those problems.

The dissertation opens with a series of objections to the applicability of geometry based on the idea that geometry fails to correspond to nature. One such objection is the claim pressed by thinkers in the Aristotelian tradition that the results which geometry proves about its objects are false if understood to be assertions about objects in nature. Because some Aristotelians did object to the applicability of geometry to nature, Aristotle himself is often charged with opposing the use of geometry in empirical inquiry. I argue that this charge is incorrect in spite of the fact that Aristotle’s theory of the sciences is generally at odds with the view that any one science can be applied in any distinct science.

Regardless of Aristotle’s own view of the issue, some Aristotelians continued to object to the applicability of geometry on the grounds that its theorems are false in nature. I consider Galileo’s reception of this objection in his *Dialogue Concerning the Two Chief World Systems*, where on my interpretation Galileo argues the objection should be recast as the claim that there are no geometric points, lines, or surfaces in nature. This is an objection both Galileo and Leibniz take seriously in developing their new mathematical physics, although I argue that Galileo and Leibniz react to the objection very differently: Galileo *rejects* the objection as false and grounded on misconceptions of geometry and nature, whereas Leibniz *grants* the truth of the objection and tries to show that it is not damaging for the project of mathematical physics. In particular, Leibniz argues that it is sufficient for the applicability of geometry that there can be curves in nature which approximate geometric curves to within any given margin of error.

I conclude the dissertation by assessing which problems of the applicability of geometry remain problems for us and examining how some of the historical solutions to problems of the applicability of geometry give general strategies for overcoming those problems.