Logical Methods in Philosophy of Science

John Dougherty

Meeting:	Fridays, 14:00–16:00 (s.t.)
	Ludwigstr. 31 / 021
Office Hours:	Thursdays, 14:00–16:00, or by appointment
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Overview

Description   This course is an overview of the impact of mathematical logic on the philosophy of science over the past century. Mathematicians use tools from quantificational logic, model theory, and category theory to study mathematical theories; philosophers of science have adapted these tools to the study of scientific theories. In this course we will look at some of these adaptations, including arguments for the meaninglessness of metaphysics, the unity of the sciences, and scientific (anti-)realism. Towards the end of the course we will also step back and consider more methodological questions about the value of formal methods in philosophy of science and how to choose between different formal analyses of the same scientific subject matter. Most of the mathematical results discussed in the readings for this course come from quantificational logic and model theory, with some basic category theory in the last two readings. We will go over these results in class, so no previous knowledge of mathematical logic is required. However, some familiarity with the notation of quantificational logic will be helpful.

Objectives   By the end of the course, you should be able to (i) clearly state a philosophical argument that has been made on the basis of a result from mathematical logic, model theory, or category theory and (ii) assess the strength of this argument and the degree to which it is actually supported by the cited mathematical result. Exhibiting ability (i) means giving a statement, in academic writing, of a mathematical result and a philosophical argument, including an explanation of the argument's philosophical significance. Exhibiting ability (ii) means describing, again in academic writing, the philosophical premises required to connect the mathematical result to a philosophical conclusion and explaining why these premises are or are not plausible in conjunction with the mathematical result and the argument's conclusion.

Assessment

The evaluation for this course will be by means of a term paper submitted at the end of the semester. If you would like to submit a term paper, you must register through LSF during the registration period (16.–27.01.2023) and submit it to me by email by the term paper deadline (TBD). Please note that extensions of this deadline are not up to me; if you need an extension, please contact Fabian Widerna (f.widerna@lmu.de) at the Prüfungsamt für Geistes- und Sozialwissenschaften (PAGS).

Your paper should be on a topic related to the use of formal methods in the philosophy of science. I will distribute a list of suggested questions and grading criteria before the registration period. You may write your paper on topic not on that list; if you do, then I recommend speaking to me before writing the paper, so that I can advise on the topic and scope of your planned alternative. The term paper should be 3000 words for BA students and 6000 words for MA students. In either case, it should be written in 12pt font, with 1.5 spacing, 3cm margins on the left and right, and a standard academic typeface (Computer Modern, Palatino, Times New Roman, Calibri, etc.)

Resources

Questions about the administration of philosophy teaching at LMU should be directed to Thomas Wyrwich (thomas.wyrwich@lrz.uni-muenchen.de). The Erasmus coordinator for philosophy at LMU is Peter Adamson (office.peter.adamson@lrz.uni-muenchen.de). The list of women's representatives (Frauenbeauftragte) for the Philosophy Faculty can be found on the Faculty's webpage (https://www.philosophie.uni-muenchen.de/fakultaet/frauenbeauftragte/index.html). Issues regarding the economic, social, and cultural aspects of student life—including studying with a child or studying with a disability—are the responsibility of the Munich Student Union (https://www.studentenwerk-muenchen.de).

Schedule and readings

21.10: Introduction and course overview

28.10: The Frege–Hilbert controversy

– Patricia Blanchette, Frege and Hilbert on consistency

04.11: Overcoming metaphysics

– Rudolf Carnap, The elimination of metaphysics through the logical analysis of language

11.11: Theoretical terms

– Carl G. Hempel, The theoretician's dilemma: A study in the logic of theory construction

18.11: Unity of science; the Vienna Circle

– Thomas Nickles, Two concepts of intertheoretic reduction

25.11: Unity of science; the Lviv–Warsaw school

– Maria Kokoszyńska, On the difference between deductive and non-deductive science

02.12: Underdetermination

– Willard Van Orman Quine, On the reasons for indeterminacy of translation

– Jane English, Underdetermination: Craig and Ramsey

09.12: Model-theoretic arguments

– John A. Winnie, The implicit definition of theoretical terms

– Hilary Putnam, Models and reality

16.12: Newman's objection

– William Demopoulos and Michael Friedman, Bertrand Russell's *The Analysis of Matter*: Its historical context and contemporary interest

23.12: NO MEETING

30.12: NO MEETING

06.01: NO MEETING

13.01: The semantic approach

– Bas C. van Fraassen, To save the phenomena

20.01: Empirical adequacy

– Michaela Massimi, Saving the unobservable phenomena

27.01: Empirical equivalence

– Clark Glymour, The epistemology of geometry

03.02: Theoretical equivalence

– Neil Dewar, Sophistication about symmetries

10.02: More theoretical equivalence

– James Owen Weatherall, Why not categorical equivalence?