Philosophy of Science

Isaac Wilhelm (iwilhelm@nus.edu.sg, isaacwilhelm.com)
PH4201
Tue 3-5:30pm, AS4-0109, Spring 2027
Office hours: Tue 2pm-3pm and by appt, AS3 05-04

Course Description

Empirical science is an incredibly successful area of inquiry. In physics, biology, economics, and many other areas of science, we have learned a staggering amount about the world. In spite of this success—or perhaps, in part, because of it—science has been subjected to lots of criticism. Politicians, the humanities, the general public, and scientists themselves have criticized it: they have questioned scientific methods of inquiry, the objectivity of scientific investigation, the kind of knowledge achieved by various fields of science, and more.

In this course, students explore philosophical questions concerning science and various criticisms of it. How, exactly, do scientific theories get confirmed? In what ways do facts about probability, and facts about typicality, figure in scientific reasoning? Is science objective? What justifies inductive reasoning as it is used in science? Do the entities posited by scientific theories actually exist? As we explore these general issues, we will touch upon issues that are specific to various sub-fields of science: for instance, biology, quantum mechanics, statistical mechanics, and more.

Course Requirements

1. Participation (100 points).
    - Students are expected to ask questions, attend all lectures, and occasionally work together in small groups.
    - See the course website for the rubric which I use to grade participation.
2. Quizzes (10 points each; 11 quizzes total).
    - Due dates: from the second course meeting on, take a 5 minute reading comprehension quiz on the assigned article.
    - Your lowest quiz grade is dropped.
3. Midterm paper (100 points).
    - Due date: March 23 at 3pm.
    - This is a paper written at home. It should be 2-3k words.
    - A detailed description of this is on the course website.
4. Final (100 points).
    - Date: Apr 13 at 3pm.
    - This is an in-person exam—closed book and closed notes—which consists of writ-

ing a paper about a selection from the course readings.
- A detailed description of this is on the course website.

For information about various course policies—for instance, the late assignment policy, the grade appeals policy, and the make-up work policy—see the course websites.

1. Canvas course website: https://canvas.nus.edu.sg/courses/104340
2. My course website: isaacwilhelm.com/teaching.htm

Learning outcomes

By this course's conclusion, you should be able to

- describe several key issues in the philosophy of science,
- construct arguments in support of your views,
- present views that differ from yours in a fair and charitable manner,
- write clearly, and
- discuss complex philosophical ideas respectfully.

Plagiarism and Academic Integrity

Please adhere to the NUS policies on plagiarism and academic integrity. Penalties for violations of these policies can be severe: they include an automatic failing grade for the course, and possibly worse. A comprehensive overview of these policies can be found here:

https://www.nus.edu.sg/celc/programmes/plagiarism.html

Accessibility

This class should be a great, fun, and educational experience for everyone. And of course, everyone deserves equal access to all educational opportunities at NUS. Those with disabilities are encouraged to speak with me if that would be helpful, and to avail themselves of the services provided by the Disability Support Office:

https://nus.edu.sg/osa/student-services/student-accessibility-unit

Schedule

The readings are drawn from several sources: articles, websites, and selections from books. All readings are required. And all are posted on the course's Canvas website.

In the schedule below, I list the requirements for each week. The requirements include attending lectures, reading literature, taking short quizzes, writing a midterm paper, and taking a final. Note that the readings, for any given week, should be completed before the lecture in that week.

Announcements about changes in the readings—if they occur—will be made in class, and only later added to the syllabus. You are responsible for knowing about those changes.

Jan 12: Introduction, and Confirmation

Readings

1. Required
    - "Two Dogmas of Empiricism" (Quine).
    - "Logic and Arguments" (Wilhelm).
2. Recommended
    - "Chapter VI. Physical Theory and Experiment" (pp. 180-195) in "The Aim and Structure of Physical Theory" (Duhem).
    - "The Analytic/Synthetic Distinction" (Russell).

Jan 19: Confirmation

Readings

1. Required
    - "Studies in the Logic of Confirmation (I.)" (Hempel).
2. Recommended
    - "A New Bayesian Solution to the Paradox of the Ravens" (Rinard).

Jan 26: Objectivity and Subjectivity

Readings

1. Required
    - "Values and Objectivity" (Longino).
2. Recommended
    - "A defense of Longino's social epistemology" (Wray).
    - "How should we promote transient diversity in science?" (Wu, O'Connor).

Feb 2: Objectivity and Subjectivity

Readings

1. Required
    - "Gender and the Biological Sciences" (Okruhlik).
2. Recommended
    - "Cognitive and Non-Cognitive Values in Science" (Longino).
    - "Epistemological depth in a GM crops controversy" (Hicks).

Feb 9: Induction

Readings

1. Required
    - "Section IV: Sceptical Doubts concerning the Operations of the Understanding" (Hume).
    - "The New Riddle of Induction," pp. 59–66 (Goodman).
2. Recommended
    - "The Problem of Induction" (Henderson), at https://plato.stanford.edu/entries/induction-problem/.

Feb 16: Induction

Readings

1. Required
    - "The New Riddle of Induction," pp. 66–83 (Goodman).
    - "Prospects for a Theory of Projection," pp. 84–108 (Goodman).
2. Recommended
    - "Realism and the Absence of Value" (Dasgupta).
    - "Dasgupta's Detonation" (Sider).

Mar 2: Philosophy of Physics

Readings

1. Required
    - "Humean Supervenience" (Loewer).
2. Recommended
    - "Towards a Best Predictive System Account of Laws of Nature" (Dorst).
    - "Three Ontological Options for the Laws of the Best System" (Demarest, Wilhelm).

Mar 9: Philosophy of Physics

Readings

1. Required
    - "Chapter 1. A Modest Proposal Concerning Laws, Counterfactuals, and Explanations," in "The Metaphysics Within Physics" (Maudlin).
2. Recommended
    - "How Do Laws Produce the Future?" (Sebens).
    - "Powerful Properties, Powerless Laws" (Demarest).

Mar 16: Probability, Chance, and Typicality

Readings

1. Required
    - "A Subjectivist's Guide to Objective Chance" (Lewis).
    - "Humean Supervenience Debugged" (Lewis).
2. Recommended
    - "Correcting the Guide to Objective Chance" (Hall).
    - "Two Mistakes Regarding the Principal Principle" (Meacham).

Mar 23: Probability, Chance, and Typicality

Readings

1. Required
    - "Chapter 1. Introduction," in "Typicality in Physics" (Wilhelm).
    - "Chapter 2. Metaphysics," in "Typicality in Physics" (Wilhelm).
2. Recommended
    - "Typical" (Wilhelm).
    - "The Typical Principle" (Wilhelm).

Assignment

- Turn in midterm paper by 3pm.

Mar 30: Probability, Chance, and Typicality

Readings

1. Required
    - "Chapter 3. Epistemology," in "Typicality in Physics" (Wilhelm).
    - "Chapter 4. Distinguishing Typicality," in "Typicality in Physics" (Wilhelm).
2. Recommended

- "Typicality and Notions of Probability in Physics" (Goldstein).
- "Typicality, Irreversibility and the Status of Macroscopic Laws" (Lazarovici, Reichert).

Apr 6: Probability, Chance, and Typicality

Readings

1. Required
    - "Chapter 6. Quantum Mechanics," in "Typicality in Physics" (Wilhelm).
    - "Chapter 7. Conclusion," in "Typicality in Physics" (Wilhelm).
2. Recommended
    - "Chapter 5. Statistical Mechanics," in "Typicality in Physics" (Wilhelm).

Apr 13: Final (no lecture)

- This is a 2.5 hour exam. You will write a paper on one of three different selections from the course readings.