

PHIL 155: Nature of Science
University of Michigan, Ann Arbor
Fall 2016

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Office: **1156 Angell Hall**

Time: T/Th 11:30-1pm
Location: MH 1449
Office Hours: W 11-1pm

COURSE DESCRIPTION

This course will be a fast paced introduction to philosophy of science. The aim is to provide a broad introduction to modern scientific method, with an emphasis on how we gain knowledge from empirical observation. To achieve this, we will focus on two main goals.

The first is to develop our critical thinking and statistical literacy skills. As a result, we will study the fundamentals of formal logic, probability theory, and statistical inference. No background knowledge will be assumed – I will provide you with all the resources and assistance you need to succeed in this class – but a willingness to work through difficult content will be helpful.

The second is to provide a broad overview of substantive issues in the philosophy of science. Here, we will look at topics such as the character of scientific reasoning, the empirical method and our knowledge of the external world, the nature of observation in science, the confirmation of scientific hypotheses by empirical data, theory choice in science, scientific progress, and (time permitting) what differentiates science from non-science.

MATERIALS

I will post all readings to the Canvas site. No textbook is required. Should you want additional background, I recommend Samir Okasha, *Philosophy of Science: A Very Short Introduction*. It is concise and accessible.

ASSIGNMENTS

Five homework assignments (**50%** at 10% each), Take home final exam (**30%**), Participation (**20%**).

SCHEDULE

LOGIC & PROBABILITY

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|------|---|
| 9/6 | Introduction
No reading required. |
| 9/8 | Logic I
Required. Hacking (2001): <i>Probability and Inductive Logic</i> , Chapter 1 |
| 9/13 | Logic II
Required. Skyrms (1999): <i>Choice and Chance</i> , 4th ed., Chapter 1 |
| 9/15 | Probability I
Required. Hacking (2001): <i>Probability and Inductive Logic</i> , Chapter 6 |
| 9/20 | Probability II
Required. Handout on conditional probability |
| 9/22 | Statistical literacy I
Required. Kahneman and Tversky (1974): <i>Judgment Under Uncertainty</i> |

9/27 **Statistical literacy II**
Required. Ross (2012): *A First Course in Probability*, Excerpts

EPISTEMOLOGY

9/29 **Scientific reasoning**
Required. Okasha (2002): *Philosophy of Science*, Chapter 2

10/4 **Hypothetico deductivism**
Required. Popper (1963): *Conjectures and Refutations*, Excerpts
Optional. Popper (1959): *Logic of Scientific Discovery*, Excerpts

10/6 **Bayes Theorem as scientific method**
Required. Strevens (2013): *Notes on Bayesian Confirmation Theory*, Excerpts

10/11 **Confirmation I**
Required. Hempel (1966): *Philosophy of Natural Science*, Excerpts

10/13 **Confirmation II**
Required. Hempel (1966): *Philosophy of Natural Science*, Excerpts
Optional. Glymour (1980): *Why I am not a Bayesian*

10/18 **Confirmation and statistical practice**
Required. Gelman & Shalizi (2011): *Philosophy & the Practice of Bayesian Stats*

VALUE AND OBJECTIVITY

10/20 **Objectivity**
Required. Kuhn (1973): *Objectivity, Value Judgment, and Theory Choice*
Optional. Salmon (1990): *Tom Kuhn Meets Tom Bayes*

10/25 **No Class**
Fall Study Break

10/27 **Workshop on hypothesis testing**
No required reading.
Optional. McCloskey (2008): *The Cult of Statistical Significance*, Excerpts

11/1 **Risk and value**
Required. Goodman (1999): *The P-Value Fallacy*
Optional. Bohannon (2015): *How I Fooled Millions to think Chocolate Helps Weight Loss*
Optional. Nuzzo (2014): *Scientific Method: Statistical Errors*

11/3 **Hypothesis testing and optional stopping**
Required. Lindley (1976): *Inference for a Bernoulli Process: A Bayesian View*

11/8 **Practice session**
No Reading

EXPLANATION

11/10 **Explanation I**
Required. Hempel (1966): *Philosophy of Natural Science*, Excerpts
Required. Hempel (1965): *Aspects of Scientific Explanation*, Excerpts
Optional. Skow (2016): *Scientific Explanation*, Excerpts

- 11/15 **Explanation II**
Required. Salmon (1989): *Scientific Explanation*, Excerpts

SCIENCE AND PSEUDOSCIENCE

- 11/17 **The demarcation problem**
Required. Lakatos (1974a): *Popper on Demarcation and Induction*, Excerpts
Required. Lakatos (1974b): *Science and Pseudoscience*, Excerpts

PROGRESS

- 11/22 **Scientific revolutions**
Required. Kuhn (1962): *The Structure of Scientific Revolutions*, Excerpts
11/24 **Division of labor**
Required. Kitcher (1990): *The Division of Cognitive Labor*, Excerpts

CAUSATION VS. CORRELATION

- 11/29 **Counterfactuals**
Required. Handout on subjunctive conditionals
12/1 **Causation**
Required. Lewis (1986): *Causation*
12/6 **No Class**
Thanksgiving Break
12/8 **Workshop on regression and causal inference**
Required. Handouts on linear regression and directed acyclic graphs
12/13 **Exam Review**

ATTENDANCE AND READING

Engaged participation is an important component of this class and I expect everyone to contribute meaningfully to class discussion. This does not mean I will reward those who speak most, however. And it does not mean you cannot do well on the participation component if you're less comfortable speaking up. Learning to articulate your thoughts in a professional, courteous and persuasive manner is an invaluable skill and a goal of this course is to improve your ability to do this.

While the readings are not long, they can be very difficult. As a result, you should plan to spend a fairly significant amount of time reading and re-reading the material.

SUBMITTING ASSIGNMENTS AND LATE POLICY

All assignments must be submitted electronically no later than 11:59PM on the day they are due.

If you anticipate needing more time on an assignment, you should contact me in advance. Otherwise, late assignments will be penalized by one-third of a letter grade for each day they are late.

STUDENTS WITH DISABILITIES

If you think you need accommodation for a disability, please let me know as early as possible. As soon as you make me aware of your needs, we can work with the Office of Services for Students with Disabilities (SSD) to help us determine appropriate accommodations. SSD (734.763.3000, ssd.umich.edu) recommends accommodation through a Verified Individualized Services and Accommodations (VISA) form. Any information you provide through a VISA form will be treated as private and confidential.

PLAGIARISM

Written work submitted for a grade in this course must be your own. You are responsible for making sure that none of your work is plagiarized. You should cite the sources you rely on, and err on the side of caution where necessary. Feel free to consult me if you are not sure of the appropriate format for quotations or references.

You should also be familiar with the academic integrity policies of the College of Literature, Science & the Arts at the University of Michigan, available [here](#). Violations of these policies will be reported to the Office of the Assistant Dean for Student Academic Affairs.