

Introduction to Philosophy of Science

Philosophy 8, Summer 2015, C Session

GM Johnson, UCLA



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Time: TR 1:00-3:05pm

Place: Lakretz 120

Office Hours: W 3-5pm

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Course Overview:

This introductory course presents a survey of the main philosophical questions regarding the nature of scientific knowledge and methodology. Broadly, we will focus on four inter-related topics:

- (i) **evidence gathering and inductive reasoning,**
- (ii) **scientific explanation,**
- (iii) **theoretical virtues, and**
- (iv) **the nature of scientific theory change.**

The goal of this class will be to explore various questions relating to these topics. For example, how should we characterize scientific explanation? What is the justification, if any, for inductive reasoning? How do we measure the strength of evidence and update our beliefs accordingly? Can questions about the objective structure of reality even be answered by the sciences? To guide our investigation of these questions, we will reflect upon the history of science and explore some of the major philosophical accounts concerning scientific progress, such as Kuhn's theory of normal science and scientific revolution, Popper's falsificationism, and van Fraassen's constructivist empiricism (aka 'instrumentalism'). Finally, we will consider to what extent ethical values, political climate, and gender norms shape scientific practice and theory.

The course does not presuppose expertise in any particular field, and it introduces topics from a diverse point of view, pulling materials from physics, biology, psychology, computer science, and cognitive science.

Course Materials:

You will be required to purchase one book for the course: Peter Godfrey-Smith, *Theory and Reality*. Chicago: University of Chicago Press, 2003 (approximately \$25, and we'll use the whole book).

All other required and supplementary materials (including readings, quizzes, and writing assignments) will be available through the course website. It is very important to check it regularly for updates.

Course Policies:

Regarding classroom etiquette, the most important policy to keep in mind is to always abide by the Principle of Charity (POC). Formally, the POC requires that you interpret a speaker's statements in the most persuasive way possible, so as to render those statements rational and worthy of philosophical engagement. Intuitively, this requires that you give everyone you interact with the benefit of the doubt. A student following the POC, for example, would not speak over their fellow student or be outright dismissive of the points they're intending to convey. This applies not only to your fellow students, but also those readings with which we'll be engaging. The primary aim of the POC is ensure a respectful, worthwhile, and collaborative intellectual environment. Thus, all students will be expected to always act in ways that further these aims.

Here are some additional course policies, the explanations for which are available on the course website and will be covered on the first day of class:

- No electronics (cell phones, laptops, tablets, etc.) are permitted in class.
- Participation and attendance are mandatory.
- Late writing assignments will be penalized for each day they are late.
- Students are expected to follow section policies put forward by TAs.

Course Requirements:

Final grades will be calculated on the basis of 4 assignment categories:

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|---------------------------------|---------------------------|
| (1) daily comprehension quizzes | (10% of your final grade) |
| (2) first paper, 1-2 pages | (20% of your final grade) |
| (3) second paper, 4-5 pages | (30% of your final grade) |
| (4) final paper, 5-6 pages | (40% of your final grade) |

As you can see, this class requires a lot of writing. Philosophy is at its best when students are given the opportunity to engage deeply and critically with a topic—skills you will develop over time and with each assignment. The rising percentage distributions reward progress on these skills.

Daily Quizzes:

Students will be expected to complete daily quizzes (starting with the second class). These quizzes are administered through the CCLE website. There are two each week, and they must be completed before class begins. Each quiz will consist of two multiple choice questions. One question is about the material covered in the previous lecture; you won't be able to answer this question on the reading alone. The other question is about the content of the reading for that day. Along with each reading will be study questions. The quiz question will come either from these study questions, or some other obvious aspect of the reading. The purpose of the quiz questions is to test comprehension; they should be easy so long as you actually did the reading and attended class (provided you paid attention with each).

Written Assignments:

Prompts and details for written assignments will be made available at least one and a half weeks before the assignment is due. All written assignments will be graded anonymously by TAs.

Academic Misconduct:

Students are expected to know and to follow the university's guidelines for academic honesty. Academic misconduct can occur in a variety of ways, including (but not limited to) cheating, fabrication, and plagiarism. When in doubt about whether some academic practice is acceptable, ask your TA or the instructor for assistance. Always err on the side of avoiding misconduct. **Any suspected violation of university policy regarding academic conduct will be reported directly to the Office of the Dean of Students.** (This is a course policy, and it is not subject to revision by your TA.) In other words, **there are no exceptions.**

Academic Accommodation:

Students needing academic accommodations based on a disability should contact the Office for Students with Disabilities (OSD) at (310)825-1501 or in person at Murphy Hall A255. When possible, students should contact the CAE within the first two weeks of the term as reasonable notice is needed to coordinate accommodations.

University Resources:

For more information, refer to the following resources:

- Office of the Dean of Students: <http://www.deanofstudents.ucla.edu/Academic-Integrity>
- Student Guide to Academic Integrity:
<https://www.deanofstudents.ucla.edu/portals/16/documents/studentguide.pdf>
- UCLA Writings Programs: <http://wp.ucla.edu/>
- Office for Students with Disabilities : www.osd.ucla.edu

Schedule:

August 3 (M): Introduction and Overview

Read: Chapter One of Theory and Reality. (Optional. Recommended for students trying to get a sense of the material being covered in this course.)

August 5 (W): Logical Empiricism

Read: Chapter 2 of Theory and Reality.

This chapter covers Logical Positivism, including Logical Positivism's main tenets as well as the challenges this view faces. As you read, try to answer the following questions:

- Role of science: what does Logical Positivism claim the main aim of science is?
- Analytic/Synthetic: what is an analytic statement? what is a synthetic statement?
- Verifiability Theory of Meaning: what does this theory claim? what does 'verifiability' mean?
- Quine's Holism: Quine makes several critiques regarding the main tenets of Logical Positivism. Try to outline these criticisms. Do you think his attack is effective?

August 10 (M): Induction and Confirmation

Read: Chapter 3 of Theory and Reality

In this chapter, you'll read about the problems facing formal theories of induction and confirmation. This chapter will be largely negative in that it raises a lot of problems, but does not solve any of them. As you read, try to answer the following questions:

- Induction: what are the different types of induction? what is the problem of induction?
- The Ravens Problem: what does it mean to say that two sentences are logically equivalent? how might my seeing a white shoe confirm that all ravens are black?
- Grue: what is the definition of 'grue'? What problem does the word 'grue' pose for a formal theory of confirmation? what are the various solutions philosophers have offered to the grue problem? what was Goodman's own solution to this problem?
- Curve Fitting Problem: we often pick the simplest patterns that connect data points--but why should we think the world is simple?

August 12 (W): Popper

Read: Chapter 4 of Theory and Reality

In this chapter, you'll read about Sir Karl Popper and his views about the demarcation problem and scientific theory change. As you read, try to answer the following questions:

- Induction: what does Popper think the status of induction is? what's Popper's alternative to confirmation?
- Demarcation: what is the demarcation problem? how does Popper attempt to solve it?
- Scientific Change: what does Popper believe are the two steps of scientific theory change? what kind of conjectures should scientists be making?
- Problems: Peter Godfrey-Smith brings up the scenario of building a bridge. What is the bridge-building situation and how does it cause problems for Popper's view?

What does it mean to say a theory is highly-corroborated? how does a theory's being corroborated differ from its being confirmed?

August 14 (F): Paper 1 DUE at 12PM: Details on course website.

August 17 (M): Kuhn pt. 1 - Normal Science

Read: Chapter 5 of Theory and Reality.

In this chapter, you'll read about Kuhn's theory of scientific progress. As you read, try to answer the following questions:

- Paradigm: what is a paradigm?
- Normal Science: what is this stage and what are its characteristic markers?
- Growing Anomalies: what is this stage and what are its characteristic markers? what is an anomaly?
- Crisis: what is this stage and what are its characteristic markers? how does it differ from normal science?
- Kuhn and Popper: how are the two views similar? how are they different?

August 19 (W): Kuhn pt. 2 - Revolutions

Read: Chapter 6 and up to page 110 of Chapter 7 (stop at section 7.4) of Theory and Reality.

In chapter 6, you'll read about Kuhn's theory of Scientific Revolution. As you read, try to answer the following questions:

- Revolution: what two things need to happen before there is a revolution? why does Kuhn think that we can't say the shift from one paradigm to another is a rational process?
- Incommensurability: what does it mean to say two things are incommensurable? why does Kuhn think two individuals in different paradigms have trouble communicating?
- Relativism: what is relativism? why might one think Kuhn might be a relativist?
- Radical Kuhn: what does Kuhn say changes with a paradigm shift? what does Kuhn mean when he says scientists are "living in a different world" after a shift? what principle prompts Kuhn to hold this view?

In Chapter 7, you'll read about the theories of Imre Lakatos and Larry Laudan. As you read, try to answer the following questions:

- Lakatos: what is a scientific research program? what does Lakatos claim are the two aspects of a research program? how should a scientist choose a research program? when should they give up on a program?
- Laudan: what's a research tradition and how is it different from a research program or paradigm? what distinction between accepting a theory and pursuing a theory does Laudan make? which theories does he say we should accept and which do we pursue?

August 24 (M): Lakatos, Laudan, Feyerabend

Read: Finish Chapter 7 of Theory and Reality.

As you finish chapter 7, try to answer the following questions:

- Lakatos: what is a scientific research program? what does Lakatos claim are the two aspects of a research program? how should a scientist choose a research program? when should they give up on a program?
- Laudan: what's a research tradition and how is it different from a research program or paradigm? what distinction between accepting a theory and pursuing a theory does Laudan make? which theories does he say we should accept and which do we pursue?
- Feyerabend: what is epistemological anarchism? what does Feyerabend think the relationship between science and human creativity is? what significance does Galileo's defense of the Copernican model of the solar system have for the role of observation in science? what is the principle of tenacity?

August 26 (W): Theory-Ladenness and Implicit Bias

REQUIRED: Read Section 10.3 of Theory and Reality (pages 155-162).

REQUIRED: Complete one of the Implicit Association Tests (IAT) found here.

This will count as your quiz grade for Wednesday. Instructions: (1) Following the link and pick any of the IAT tests (I recommend the race IAT). (2) When finished, send a screenshot of the "thank you for completing the study" page to your TA. If you would not like your TA to see your results, feel free to omit the results from the screenshot. You must send a screenshot to receive all 5 quiz points for the day. (If you don't know how to take a screenshot, instructions can be found here.)

HIGHLY RECOMMENDED: Read selections from Blind Spot by Mahzarin R. Banaji and Anthony G. Greenwald. The relevant passages can be found on the course website. Try to at least read pages 69-102, 128-134, and 138-163. (This might seem like a lot, but the reading goes fast.)

August 28 (F): Paper 2 DUE at 12PM: Details on course website.

August 31 (M): Feminist Philosophy of Science

Read: Longino Article found on course website.

This is a difficult, yet rewarding article. In it, you'll read Longino's argument that Kuhn's set of traditional theoretical virtues are not constitutive to the sciences. As you read, try to answer the following questions:

- Constitutive vs Contextual: what is meant by these two words? what does it mean to say that a virtue of a theory is contextual rather than constitutive?
- Feminist Theoretical Virtues: Longino lists 6 feminist theoretical virtues. what are these 6 virtues? for each virtue, try to write down a 1-2 sentence summary of what it would mean for a theory to have that virtue.
- Traditional vs Feminist: Longino puts forward several examples that are meant to demonstrate that a community's choice between the feminist virtues or the traditional virtues are contextual. what are some of these examples? if Longino's argument succeeds, what is the status of the traditional list of virtues?

September 2 (W): Realism

Read: Chapter 12 of Theory and Reality.

In this chapter, you'll read about various views regarding the status of science as giving us accurate descriptions of the world. As you read, try to answer the following questions:

- **Realism:** what is scientific realism? what is the version of naive realism presented by Peter Godfrey-Smith? how do these two views relate?
- **Metaphysical Constructivism:** what is Kant's distinction between the "noumenal" world and the "phenomenal" world? how does this relate to Kuhn's theory that the world changes when a paradigm shifts? what is the "Bad view" and why is it problematic?
- **Bas van Fraassen:** what does van Fraassen claim is the concern of science? how are we to understand the boundary between observable and unobservable according to van Fraassen? why is this boundary important for van Fraassen's view?

September 7 (M): NO CLASS (Labor Day)

No Reading.

September 9 (W): Explanation

Read: Chapter 13 of Theory and Reality.

In this chapter, you'll read about various attempts to categorize the nature of scientific explanation. As you read, try to answer the following questions:

- **Important Terminology:** in an explanation, what is the explanandum? what is the explanans?
- **Explanation:** why might someone think that explanations are an important aspect of scientific inquiry? why might someone think explanations go beyond or lie outside of scientific inquiry?
- **Covering Law Model of Scientific Explanation:** according to the covering law model, what is required in order to have a scientific explanation?
- **Causal Model of Scientific Explanation:** why is causation considered a dubious concept by philosophers of science?
- **Unificationist Model of Scientific Explanation:** according to the unificationist model, what is required in order to have an explanation? how does this model differ from the covering law model?
- **Contextualist Model of Scientific Explanation:** how does PGS think we should characterize scientific explanation? what is van Fraassen's pragmatic approach to explanation? how do these two approaches differ?

September 11 (F): Paper 3 DUE at 12PM: Details on course website.