

PHILOSOPHY 321: Philosophy of Science

Spring 2016

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Preceptors:

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Classes:

- 2 lectures each week, 12:30-1:20pm T/Th
- 1 precept each week, times TBD

Materials:

- No books required: all readings will be made available on Blackboard.
- Students will need access to argument mapping software. Go to <https://www.rationaleonline.com>, create an account with your Princeton email address, and purchase an “Educational Basic” subscription for \$30. The code qtqx8ct8 gives you a 10% discount (though if you use the code you will not be entitled to the 50% discount if and when you choose to renew your subscription).

Assessment:

- Levels system (see handout), 35%
- Final exam, 30%
- Final paper, 35%

Academic Integrity:

- I strongly encourage you to discuss the material in this class with other students. This includes your ideas for papers: their feedback will improve your ideas.
- Your papers and argument maps should then be your own work. This means that, having talked about your ideas with friends, you should sit down on your own and write the paper or map yourself.
 - ★ It’s fine to get feedback from other students on drafts. But the other student should not re-write anything for you.
 - ★ It’s also fine to use the writing center—in fact this is encouraged!
- Please see the University’s booklet on academic integrity: <http://www.princeton.edu/pr/pub/integrity/pages/intro/index.htm>

Syllabus

The concepts of space, time, and chance have long been of interest to philosophers. This class will investigate how our thinking about these concepts has been shaped by developments in science. We'll start by discussing the structure of space and time in classical and relativistic physics. We'll then turn to the notion of chance, investigating its role in statistical mechanics, quantum mechanics, evolutionary biology, and intelligent design. Over the semester we'll be building towards a certain uniform account of chance that also helps explain how the different sciences hang together. And along the way, we'll use our discussions of these particular sciences as gateways into more general issues in the philosophy of science such as realism vs anti-realism, reductionism, the nature of scientific laws, the demarcation problem, and the "scientific method".

This class has no prerequisites: all the relevant science will be introduced in class from scratch.

All readings are required unless marked "Supplementary". They are available in PDF format on Blackboard. Full bibliographic details are contained within the PDFs.

Topic 1: Space and time in classical physics

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| Tues Feb 2nd | Introduction |
| Thurs Feb 4th | The bucket argument <ul style="list-style-type: none">• Dasgupta, "Substantivalism vs Relationalism about Space in Classical Physics", sections 1-3 |
| Tues Feb 9th | Symmetry arguments and Galilean space-time <ul style="list-style-type: none">• Dasgupta, "Substantivalism vs Relationalism about Space in Classical Physics", sections 4-6 |
| Thurs Feb 11th | Humeanism vs anti-humeanism about laws <ul style="list-style-type: none">• Beebe, "The Non-Governing Conception of Laws of Nature"• Loewer, "Humean Supervenience" |

Supplementary reading:

- Sklar, *Space, Time, and Spacetime*, chapter 3 (a classic overview of the substantivalism vs relationalism debate)
- The Leibniz-Clarke correspondence, reprinted in Huggett, *Space from Zeno to Einstein*, chapter 8: "Leibniz and Clark"
- Horwich, "On the Existence of Time, Space and Space-Time" (on the bucket argument, and also symmetry arguments)
- Schaffer, "Causation and Laws of Nature: Reductionism"
- Lewis, *Philosophical Papers: Volume 2*, Introduction

Topic 2: Space and time in relativistic physics

- Tues Feb 16th** Special relativity
- Maudlin, *Philosophy of Physics: Space and Time*, chapter 4: “Special Relativity”
- Thurs Feb 18th** General relativity
- Maudlin, *Philosophy of Physics: Space and Time*, chapter 6: “General Relativity”
- Tues Feb 23rd** Conventionalism about geometry
- Reichenbach, *The Philosophy of Space and Time*, chapter 1, pp. 1-37

Supplementary reading:

- Friedman, “Geometry, Convention and the Relativized Apriori: Reichenbach, Schlick and Carnap”
- Sklar, *Space, Time, and Spacetime*, chapter 2, pp. 79-147 (on the epistemology of geometry)

Topic 3: Is there a scientific explanation of the direction of time?

- Thurs Feb 25th** Entropy and Statistical Mechanics I
- North, “Time in Thermodynamics”
- Tues March 1st** Entropy and Statistical Mechanics II
- North, “Time in Thermodynamics”
- Thurs March 3rd** Chance
- Briggs, “The Metaphysics of Chance”
 - Loewer, “David Lewis’ Humean Theory of Objective Chance”
- Tues March 8th** Epistemic Catastrophe
- Sean Carroll, *From Eternity to Here*, chapter 10: “Recurrent Nightmares”
- Thurs March 10th** TBD / Catch-up

Supplementary reading:

- Albert, *Time and Chance*, chapters 3 and 4
- Frigg, “What is Statistical Mechanics?”
- Lewis, “Humean Supervenience Debugged”
- Briggs, “The Anatomy of the Big Bad Bug”

- Gillies, *Philosophical Theories of Probability*, pp. 88-105, 113-136

SPRING RECESS

Topic 4: Chance in quantum physics

- Tues March 22nd** Introduction to classical quantum mechanics
- Ney, *The Wave Function: Essays on the Metaphysics of Quantum Mechanics*: Introduction
- Thurs March 24th** Scientific realism and the measurement problem
- van Fraassen, *The Scientific Image*, chapter 2: “Arguments Concerning Scientific Realism”, pp. 6-25.
- Tues March 29th** The GRW interpretation
- Albert, *Quantum Mechanics and Experience*, chapter 5: “The Collapse of the Wave Function”
- Thurs March 31st** No class
- Tues April 5th** The Bohmian interpretation
- Albert, *Quantum Mechanics and Experience*, chapter 7: “Bohm’s Theory”

Supplementary reading:

- Albert, *Quantum Mechanics and Experience*, chapters 1 and 4
- Boyd, “On the Current Status of the Issue of Scientific Realism”, sections 1, 2, 3, 6
- Fodor, “Observation Reconsidered”
- Ney, “The Status of Our Ordinary Three Dimensions in a Quantum Universe”

Topic 5: Is there a scientific explanation of our existence?

- Thurs April 7th** Design arguments
- Sober, “The Design Argument”, pp. 117-126
 - Strevens, *Notes on Bayesian Confirmation Theory*, chapters 1-5
- Tues April 12th** Responses to design arguments
- Sober, “The Design Argument”, pp. 126-141
 - Dawkins, *The God Delusion*, pp. 134-151

- Thurs April 14th** Intelligent design and the demarcation problem
- Sober, *Philosophy of Biology*, chapter 2: “Creationism”
 - Nagel, “Public Education and Intelligent Design”

Supplementary reading:

- Collins, “God, Design, and Fine-Tuning” (a defense of the fine-tuning argument)
- Weisberg, “The Argument From Divine Indifference” (a putative refutation of the design argument)
- Sober, *Evidence and Evolution*, chapters 1 and 2 (detailed discussion of Bayesianism and intelligent design)
- Orr, “Darwin vs Intelligent Design (Again)”; Behe, “The Sterility of Darwinism”; and Orr, “H. Allen Orr Responds” (a back and forth on Darwin vs intelligent design)
- Hasker, “Intelligent Design”

Topic 6: Chance in evolutionary biology

- Tues April 19th** Fitness
- Mills and Beatty, “The Propensity Interpretation of Fitness”
 - Sober, “Two Faces of Fitness”

- Thurs April 21st** Adaptationism
- Sober, *Philosophy of Biology*, chapter 5: “Adaptationism”
 - Gould and Lewontin, “The Spandrels of San Marco and the Panglossian Paradigm”

- Tues April 26th** The mentaculus: can physics explain everything?
- Albert, “Physics and Chance”
 - Frisch, “Why Physics Can’t Explain Everything”

- Thurs April 28th** Reduction
- Loewer, “Why is There Anything Except Physics?”

Supplementary reading:

- Sober, *Philosophy of Biology*, chapter 3 (on fitness)
- Sterelny and Griffiths, *Sex and Death*, chapter 10: “Adaptation, Perfection, Function” (on adaptationism)
- Kitcher, “1953 and All That”
- Weslake, “Statistical Mechanical Imperialism”