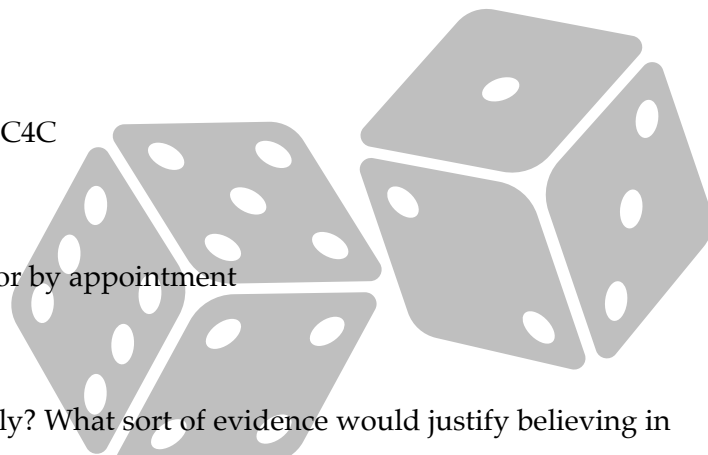# PHI 371: Philosophical Foundations of Probability and Decision Theory

Spring 2020, Tuesdays 13.30-16:20pm, Green Hall 1C4C

Instructor: Dan Hoek; dhoek@princeton.edu

Website: danielhoek.com/teaching

Office hours: Wednesday 10-12, in 109 Marx Hall, or by appointment

Course Summary

What makes a story improbable or an event unlikely? What sort of evidence would justify believing in a miracle? Do probabilities even make sense if the world is deterministic? What if anything does Quantum Mechanics tell us about the nature of probability? How should we factor risk into our decisions? What should we do in a situation where we do not know the probabilities of the outcomes? We will attack these and other questions and puzzles through the lens of analytic philosophy and decision theory.

Assessment

Participation (15% of grade). Showing up to class, doing the readings, staying focused, participating in discussion, paying attention to what other students say, keeping phones and laptops away.

Problem Sets (40% of grade). Assigned periodically during the semester. The problem sets will all be available through Blackboard.

Midterm Assignment (20% of grade). A structured, 1000-word essay assignment due March 26th.

Final Term Paper (25% of grade). An open, 2000-word essay assignment due May 15th.

Reading Assignments. We will be reading two or three book chapters and research papers a week that I will make available to you via Blackboard, so no textbook is required. A provisional week-by-week plan for the readings is given below. Often only a portion of the readings is required — the rest will be optional; sometimes I will designate a whole paper as optional reading. Since many of the contain quite complex and technical arguments, you should do the required readings carefully and slowly, making an effort to understand all the reasoning steps the author makes. On the other hand, feel free to skim or skip any optional reading; I will not assume that you have read any of it. Write down questions you have about the readings, and things you did not understand. There will be opportunity to discuss those questions in class.

Homework Submission. All problem sheets and assignments must be submitted *anonymously* through Blackboard. Do not include your name or student number in the submission.

Final Paper. In your final paper, your job will be to (i) explain one of the philosophical issues discussed in class in your own words, in a way that can be easily understood by someone who has not taken the course, (ii) summarise one of the arguments given in the readings about that issue and (iii) provide your own response to that argument — for instance, you might give an objection or reply to a possible objection. I will suggest a few possible essay topics, but you should stay on the lookout throughout the semester for topics you might want to write about. If you have an idea that you think might make a good paper, send me an e-mail about it, or you can come talk to me in office hours — I will consider alternative paper proposals until April 16th. You will have the option to hand in a penultimate draft of the final paper on April 30th. I will grade this draft and give you written comments and suggestions for improving your final submission.

Collaboration on Problem Sets and Papers. You're very much encouraged to talk with other students about the assigned reading, and the homework assignments! You can also share drafts with one another. Be generous in sharing ideas: it pays dividends. However: (1) Document who you talked to, and if there is a particularly neat insight you end up using, credit that person. (2) The work you produce should arise from your own understanding of the material. In other words, talk with others to help understand the material or question, but then create your own work based on that discussion. Do not, under any circumstances, copy another person's work. When in doubt, ask me!

Missing class. If you need to miss a class, always email me *in advance*. If you do miss a class, it is your responsibility to find out from another student what happened and to get copies of notes and handouts. After doing that, if you still have questions about what was covered, please meet with me (for instance during office hours) to discuss them.

Late assignments. All homework assignments should be handed in by 8pm on the due date. The default policy is that late submissions are not accepted, and incur a D grade. If you foresee that you will not be able to hand in your assignment on time, I *may* still grant you an extension if you let me know *well in advance* — no later than two days before the due date. Even if an extension is granted, there could still be a grade penalty. Don't be a perfectionist.

Office Hours. You are always welcome to come see me during office hours with any questions you have about the course, about probability, or about paper ideas. If you are struggling to keep up with the course for any reason, you should definitely come to see me.

Tentative Schedule

I. Introduction
February 4th. *Deduction and Induction*
   Ian Hacking, Chapter 1, 2 and 4

February 7th. Problem Set 1 due.

II. Probability and Evidence
February 11th. *Of Miracles and Lotteries*
   Michael Strevens, "Notes on Bayesian Confirmation Theory," §1-§4.1, §5
   Dawid and Gillies "A Bayesian Analysis of Hume's Argument Concerning Miracles."

February 18th. *The Problem of Induction*
   Peter Godfrey Smith, "Induction and Confirmation," in his *Theory and Reality*.
   Michael Strevens, "Notes on Bayesian Confirmation Theory," §6-9

February 21st. Problem Set 2 due.

February 25th. *Self-Locating Credences and the Sleeping Beauty Paradox*
   Adam Elga, "Self-locating belief and the Beauty problem."
   David Lewis, "A Subjectivist's Guide to Objective Chance."
   David Lewis, "Sleeping Beauty: Reply to Elga."

III. Probability and Decisions
March 3rd. *Dutch Book Arguments and Representation Theorems*
   Frank Ramsey, "Truth and Probability."
   David Lewis, "Why Conditionalise?"
   Johanna Thoma, "Decision Theory," §1, §3.1-2

March 10th. *Causal and Evidential Decision Theory*
   Robert Nozick, "Newcomb's Problem and Two Principles of Choice," §1
   Gibbard and Harper, "Counterfactuals and Two Kinds of Expected Utility," §1-3, §10
   Andy Egan, "Some Counterexamples to Causal Decision Theory."

March 12th. Problem Set 3 due.
March 17th. Spring Recess.

March 24th. *Alternatives to Expected Utility*

      L.J. Savage "Difficulties in the theory of personal probability."

      Miriam Schoenfield, "Decision-Making in the Face of Parity."

      Lara Buchak, "Precis of *Risk and Rationality*"

March 26th. Midterm Assignment due.

March 31st. *Paradoxes of Infinity*

      Nick Bostrom, "Pascal's Mugging."

      Arntzenius, Elga and Hawthorne, "Bayesianism, Infinite Decisions, and Binding," §1

IV. Probability and Justice

April 7th. *Statistical Evidence and Prejudice*

      Judith Jarvis Thompson, "Liability and Individualist Evidence"

      Rima Basu, "Does Fairness Require Inaccuracy?"

V. Probability and Mathematics

April 14th. *Chance and the Continuum Hypothesis*

      Agustín Rayo, "Non-Measurable Sets." *On the Brink of Paradox*, chapter 7.

      Chris Freiling, "Axioms of Symmetry: Throwing Darts at the Real Number Line," §1-3

      Daniel Hoek, "Chance and the Continuum Hypothesis."

April 16th. Problem Set 4 due. Final Paper proposals will not be accepted after this date.

VI. Physical Probability

April 21st. *Chance, Determinism and Statistical Mechanics*

      Barry Loewer, "Determinism and Chance."

      Michael Strevens, "Inferring Probabilities from Symmetries."

      Sean Carroll, "Why Boltzmann Brains are Bad."

April 28th. *Chance and Quantum Mechanics*

      David Albert, "Quantum Mechanics and Experience," Ch. 1 (2-4 optional)

      David Albert and Barry Loewer, "Interpreting the Many Worlds Interpretation."

      Hillary Greaves, "Understanding Deutsch's Probability in a Deterministic Multiverse," §1-4.

April 30th. Paper draft due.

May 5th. Paper Feedback.

May 15th. Final Paper Due.