Probability Puzzles and Bayesian Epistemology

Syllabus

Course Details

Instructor	Lennart Ackermans
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Office Hours	By appointment
Seminar Room	Ludwigstraße 31, Room 028
Time	Mondays, 16:00-18:00 c.t.

Description

Bayesian epistemology is all about what it means to have rational beliefs. Bayesians maintain that beliefs are usually not all-or-nothing but instead come in degrees. One might be 90% certain that the SPD is currently part of the German government. Or one might be 50% certain that a coin about to be tossed will land heads.

There is widespread agreement among Bayesians that rational degrees of belief are probabilities. That is, they can be expressed as functions that assign propositions a number between 0 and 1, and these functions satisfy the probability axioms. This view is known as *probabilism*. But probabilism is not the only requirement of rationality. A complete theory of Bayesian rationality has as of yet not been developed (or so it seems). One way to learn more about the requirements of rationality is through probability puzzles.

At first glance, a typical probability puzzle might seem like a simple riddle. But in attempting to solve it, one often encounters deeper problems than the problem itself. Sometimes there is an agreed upon solution, but accepted principles of rationality seem to conflict with it. At other times, Bayesians disagree about the solution, raising the question of whether there is one that is uniquely rational. And occasionally, the puzzle lies not in finding the correct solution but the question that it purportedly answers.

In each session, we will discuss a probability puzzle. Most of these puzzles relate to principles of rationality that are central to various Bayesian schools of thought:

- Conditionalization
- The Principle of Indifference
- Direct inference from frequencies.

With the help of probability puzzles, we will aim to develop a deeper understanding of these principles and their problems.

Requirements

1. **Prepare for the seminars.** I will try to keep the required readings to a minimum. In return, I expect you to think about the problems carefully and work out your own solutions. Please come to the seminar with at least one question about the readings.
2. **Present a a probability puzzle.** In week 14 (26 January), we will hold a student colloquium where each of you will present a probability puzzle. This is not a graded requirement, but highly recommended as preparation for writing your term paper. The length of your presentation can be up to 15 minutes.

   Please let me know your topic by 15 December.
3. **Write a term paper based on your presentation.** The term paper discusses a probability puzzle and relates it to questions about Bayesian rationality. The recommended length is around 4000 words. There is no lower and upper limit. The final grade of the course depends solely on the term paper. The grading criteria are available here.

   It is possible to submit an initial version of your paper for feedback (ungraded). **Please do so by 16.02.2026.**

   The deadline for submitting the term paper is 23.03.2026.

Seminar Schedule

The seminar schedule is subject to change throughout the course. Please always consult the latest version in LSF for next week's readings.

Session	Topic and Readings
Week 1	*Foundations of Bayesian Probability*
13.10.2025	**Required readings** • Chapters 2, 3.1, 3.2, and 4.1 from Michael G. Titelbaum (2022). *Fundamentals of Bayesian Epistemology 1*. CH2 CH3 CH4 This might already be familiar to some of you. Please skim it and decide for yourself which parts are worthwhile to read. • Start with the readings for next week. **Further readings** • Chapter 1 from Michael G. Titelbaum (2022). *Fundamentals of Bayesian Epistemology 1*. DL This chapter may be helpful to understand what credences a.k.a. degrees of belief are.

- Susan Vineberg (2020). “Dutch Book Arguments”, *The Stanford Encyclopedia of Philosophy*. https://plato.stanford.edu/archives/fall2022/entries/dutch-book

  Dutch book arguments are popular to defend probabilism, the thesis that degrees of belief should satisfy the probability axioms.

- Section 5.1 and 5.2 from Richard Pettigrew (2024). “Epistemic Utility Arguments for Epistemic Norms”, *The Stanford Encyclopedia of Philosophy.* https://plato.stanford.edu/archives/sum2024/entries/epistemic-utility/

  Epistemic utility arguments offer a different way to defend probabilism.

- Alan Hajék (2008). “Arguments for–or against–Probabilism?” *The British Journal for the Philosophy of Science*, 59(4), 793–819.

Week 2 *The Road to Shangri-La*

20.10.2025 **Required readings**

- Chapter 6 from Michael G. Titelbaum (2013). *Quitting Certainties: A Bayesian Framework Modelling Degrees of Belief.* DL
- Chapter 3 from Michael G. Titelbaum (2013). *Quitting Certainties: A Bayesian Framework Modelling Degrees of Belief.*

  This chapter is optional. Read it if you need more background information to understand chapter 6.

- Until page 473 of Brian Hedden (2015). “Time-Slice Rationality”, *Mind*, 124(494), 449–491. DL

Further readings

- Frank Arntzenius (2003). “Some Problems for Conditionalization and Reflection”, *The Journal of Philosophy*, 100(7), 356–370.
- Rachael Briggs (2009). “Distorted Reflection”, *The Philosophical Review*, 118(1), 59–85.
- Jonathan Weisberg (2007). “Conditionalization, Reflection, and Self-Knowledge”, *Philosophical Studies*, 135, 179–197.
- Adam Elga (2007). “Reflection and Disagreement”, *Noûs*, 41, 478–502.
- See also the readings on the Absent-Minded Driver Problem in Week 12.

Week 3 *Cube Factory*

03.11.2025 **Required readings**

- Chapter 12 of Bas C. Van Fraassen (1989). *Laws and symmetry.* DL

  Focus on 12.5 and 12.6.

- Section 1–4 of Roger White (2010). "Evidential Symmetry and Mushy Credence", in Gendler, Tamar Szabó and John Hawthorne, *Oxford Studies in Epistemology Volume 3*. DL

Further readings

- Benjamin Eva (2019). "Principle of Indifference", *The Journal of Philosophy*, 116(7), 390–411.
- Greg Novack (2010). "A Defense of the Principle of Indifference", *Journal of Philosophical Logic*, 39, 655–678.
- See also the readings for week 5.

Week 4 *Mystery Urns*

27.10.2025

Required readings

- Until page 296 of James M. Joyce (2010). "A Defense of Imprecise Credences in Inference and Decision Making", *Philosophical Perspectives*, 24: 281-323. DL
- Clinton Castro and Casey Hart (2019). "The imprecise impermissivist's dilemma", *Synthese*, 196, 1623–1640. DL

Further readings

- Anna Mahtani (2019). "Imprecise Probabilities", in Pettigrew and Weisberg (2019), *The Open Handbook of Formal Epistemology*: 107–130. DL
- Sarah Moss (2021). "Global Constraints on Imprecise Credences: Solving Reflection Violations, Belief Inertia, and Other Puzzles", *Philosophy and Phenomenolical Research*, 103, 620–638. DL
- Adam Elga (2010). "Subjective Probabilities Should be Sharp", *Philosophers' Imprint*, 10(5), 1–11. DL
- Roger White (2010). "Evidential Symmetry and Mushy Credence", in Gendler, Tamar Szabó and John Hawthorne, *Oxford Studies in Epistemology Volume 3*. DL

Week 5 *Coin Game*

10.11.2025

Required readings

- Section 5 of Roger White (2010). "Evidential Symmetry and Mushy Credence", in Gendler, Tamar Szabó and John Hawthorne, *Oxford Studies in Epistemology Volume 3*. DL
- Pages 296–307 of James M. Joyce (2010). "A Defense of Imprecise Credences in Inference and Decision Making", *Philosophical Perspectives*, 24: 281-323. DL

Further readings

- James Hawthorne, Jürgen Landes, Christian Wallmann, and Jon Williamson (2017). "The Principal Principle Implies the Principle of Indifference", *The British Journal for the Philosophy of*

	Science, 68:1, 123-131. DL Responses: ◦ Michael G. Titelbaum and Casey Hart (2020). "The Principal Principle Does Not Imply the Principle of Indifference, Because Conditioning on Biconditionals Is Counterintuitive", *The British Journal for the Philosophy of Science*, 71:2, 621-632. ◦ Jürgen Landes, Christian Wallmann, and Jon Williamson (2021). "The Principal Principle, admissibility, and normal informal standards of what is reasonable", *European Journal for Philosophy of Science*, 11, 36. • Casey Hart and Micheal G. Titelbaum (2015). "Intuitive Dilation?", *Thought: A Journal of Philosophy*, 4, 252-262.
Week 6 17.11.2025	*The ACME Urn Company* **Required readings** • Paul D. Thorn (2012). "Two Problems of Direct Inference", *Erkenntnis,* 76, 299–318. DL **Further readings** • In response to Thorn (2012): ◦ Wallmann, C (2017). "A Bayesian Solution to the Conflict of Narrowness and Precision in Direct Inference", *Journal for General Philosophy of Science*, 48, 485–500. DL • Christian Wallmann and James Hawthorne (2020). "Admissibility Troubles for Bayesian Direct Inference Principles", *Erkenntnis*, 85, 957–993. DL • Lennart B. Ackermans (2022). "Infinite frequency principles of direct inference", *Synthese*, 200, 164. DL
Week 7 24.11.2025	*Intermezzo: the Objects of Credence* **Required readings** • Chapter 2 and 4 of Anna Mahtani (2024). *The Objects of Credence*. CH2 CH4 **Further readings** • Christian List (2024). "Probabilistically coherent credences despite opacity", *Economics and Philosophy*, 40(2), 497-506. DL
Week 8 01.12.2025	*The Two-Envelope Paradox* **Required readings** • Lennart B. Ackermans (2025). "Four Formal Versions of The Two-Envelope Paradox." DL **Further readings**

	• Terry Horgan (2000). "The Two-Envelope Paradox, Nonstandard Expected Utility, and the Intensionality of Probability", Noûs, 34(4), 578–603. DL • Bernard D. Katz, Doris Olin (2007). "A Tale of Two Envelopes", Mind, 116(464), 903–926. DL • Chapter 6 of Anna Mahtani (2024). *The Objects of Credence*. DL
Week 9 08.12.2025	*The Doomsday Argument* **Required readings** • Peter J. Lewis (2013). "The Doomsday Argument and the Simulation Argument", *Synthese* 190, 4009–4022. DL **Further readings** • Nick Bostrom (1999). "The doomsday argument is alive and kicking", *Mind* 108(431). DL
Week 10 15.12.2025	*The Sleeping Beauty Problem* **Required readings** • Adam Elga (2000). "Self-Locating Belief and the Sleeping Beauty Problem", *Analysis*, 60(2), 143–147. DL • Nick Bostrom (2007). "Sleeping Beauty and Self-location: A Hybrid Model", *Synthese*, 157, 59–78. DL **Further readings** • Michael G. Titelbaum (2012). "An Embarrassment for Double-Halfers". *Thought: A Journal of Philosophy*, 1, 146-151. DL • Lennart B. Ackermans (2025). "A Nightmare for Lewisian Halfers". DL • Chapter 8 and 9 of Michael G. Titelbaum (2013). *Quitting Certainties: A Bayesian Framework Modelling Degrees of Belief.* DL
Week 11 22.12.2025	*Cancelled*
Week 12 12.01.2026	*The Absent-Minded Driver* **Required readings** • Wolfgang Schwarz (2015). "Lost memories and useless coins: revisiting the absentminded driver", *Synthese*, 192, 3011–3036. DL **Further readings** • Wolfgang Spohn (2025). "The Puzzle of the Absent-Minded Driver is Not about Absent-Mindedness, but about Indexical Belief." *Homo Oeconomicus* • Caspar Oesterheld and Vincent Conitzer (2021). "Extracting

	Money from Causal Decision Theorists", *The Philosophical Quarterly*, 71(4), pqaa086.
Week 13 19.01.2026	*The Judy Benjamin Problem* **Required readings** • Jan-Willem Romeijn (2011). "A New Resolution of the Judy Benjamin Problem", *Mind*, 120(479), 637–670. DL **Further readings** • Benjamin Eva, Stephan Hartmann, Soroush Rafiee Rad (2020). "Learning from Conditionals", *Mind*, 129(514), 461–508. DL
Week 14 26.01.2026	*Student Colloquium*
Week 15 02.02.2026	*Cancelled. You can make an appointment to discuss your essay idea.*

Other puzzles

Some interesting topics have unfortunately not made it into the syllabus. Contact me if you want to write a paper about any of these:

- Paradoxes and problems related to the use of infinite sample spaces and countable additivity.
- Simpson's paradox and the causal Markov condition.
- The problem of old evidence (discussed in Stephan Hartmann's course).
- The Cable Guy paradox.
- Newcomb's paradox.