

## PHIL 3250 – Inductive and Scientific Reasoning

3010 Brown Hall

Tues. 3:00-5:30

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<https://elearning.wmich.edu/d21/home/192341>

**Required Text:** *Scientific Reasoning: The Bayesian Approach* (Howson & Urbach)

All other readings will be made available at [homepages.wmich.edu/~jnk5408](http://homepages.wmich.edu/~jnk5408).

**Course Description:** This course will study the principles underlying scientific and inductive reasoning. We'll begin by trying to get clear about some of the main concepts we'll be dealing with throughout the semester by asking, What makes something a science? What makes a certain pattern of reasoning scientific? What is a scientific theory? and What counts as evidence in favor of a particular theory? We will then explore some of the most important theories of how evidence confirms or disconfirms scientific theories. In particular, we will evaluate so-called classical and Bayesian theories of confirmation in terms of how well they fit the practice of actual reasoning in science as well as in terms of how well they deal with a number of well-known paradoxes of confirmation. After seeing these theories in action in both deterministic and statistical settings, we will turn to several other important features of scientific reasoning: we will consider the value of theoretical simplicity; the role of inference to the best explanation in science; the often patchwork nature of reasoning in the face of complexity; and how to proceed when dealing with inconsistent theories or pieces of evidence.

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| Week 1 | Sept. 8  | Introduction: What makes something a science?<br>— Popper, <i>The Logic of Scientific Discovery</i> , Ch. 1   |
| Week 2 | Sept. 15 | What is scientific reasoning?<br>— Logic refresher handout<br>— Okasha, <i>Philosophy of Science: A Very Short Introduction</i> , Ch. 2   |
| Week 3 | Sept. 22 | Concepts of evidence and the problem of induction<br>— Achinstein, <i>The Book of Evidence</i> , Ch. 2<br>— <i>Scientific Reasoning</i> , Ch. 1   |
| Week 4 | Sept. 29 | Classical confirmation, ravens, and grue<br>— Glymour, <i>Theory and Evidence</i> , Ch. 2<br>— Goodman, <i>Fact, Fiction, and Forecast</i> , Ch. 3<br>— Hempel, <i>Studies in the Logic of Confirmation</i> |
| Week 5 | Oct. 6   | Introducing the probability calculus and its interpretations<br>— <i>Scientific Reasoning</i> , Ch. 2<br>— Hacking, <i>An Introduction to Probability and Inductive Logic</i> , selections                  |

- Week 6 Oct. 13 Further development of the laws of probability  
— *Scientific Reasoning*, Ch. 3  
— Stone, *Bayes' Rule: A Tutorial Introduction to Bayesian Analysis*, Ch. 1 & 2
- Week 7 Oct. 20 Bayesian confirmation for deterministic theories (MIDTERM DISTRIBUTED)  
— *Scientific Reasoning*, Ch. 4
- Week 8 Oct. 27 Classical confirmation in statistical theories (MIDTERM DUE)  
— *Scientific Reasoning*, Ch. 5 & 6
- Week 9 Nov. 2 Regression analysis: classical and Bayesian  
— Sykes, *An Introduction to Regression Analysis*  
— *Scientific Reasoning*, Ch. 7
- Week 10 Nov. 9 Bayesian confirmation for statistical theories  
— *Scientific Reasoning*, Ch. 8
- Week 11 Nov. 16 Critiques of Bayesian confirmation  
— Earman, *Bayes or Bust: A Critical Examination of Bayesian Confirmation Theory*, Ch. 5  
— Glymour, *Theory and Evidence*, Ch. 3  
— *Scientific Reasoning*, Ch. 9
- Week 12 Nov. 23 Simplicity and inference to the best explanation  
— Baker, *Occam's Razor in Science: A Case Study from Biogeography*  
— Harman, *The Inference to the Best Explanation*  
— Aliseda, *Abductive Reasoning: Logical Investigations into Discovery and Explanation*, Ch. 5
- Week 13 Nov. 30 Reasoning in the face of complexity  
— Batterman, *The Devil in the Details: Asymptotic Reasoning in Explanation, Reduction, and Emergence*, Ch. 1  
— Wilson, *Wandering Significance: An Essay on Conceptual Behavior*, Ch. 4
- Week 14 Dec. 7 Coping with inconsistent theories (FINAL PAPER DUE)  
— Vickers, *Understanding Inconsistent Science*, selections  
— Woods, *Paradox and Paraconsistency: Conflict Resolution in the Abstract Sciences*, Ch. 3

**Assignments:** Half of your grade for this course will come from homework grades. I will assign homework nearly every week, be it in the form of problems or in the form of short (~1 page) expository papers. You'll be able to drop the homework assignment with the lowest score at the end of the semester. It should work out to each assignment being about 5% of your final grade.

Weekly Homeworks	50%		Due at the beginning of class
Midterm Exam	15%	Take home exam	Due Oct. 27
Final Paper	20%	Medium-length evaluative paper	Due Dec. 7
Participation	15%	This is necessary for a once a week course	

**Accommodations:** Any student with a documented disability who needs to arrange reasonable accommodations must contact me and the appropriate Disability Services office at the beginning of the semester. The two disability service offices on campus are: Disabled Student Resources and Services (269) 387-2116 and the Office of Services for Students with Learning Disabilities (269) 387-4411.

**Academic Honesty:** You are responsible for making yourself aware of and understanding the university's [policies and procedures](#) that pertain to Academic Honesty. If there is reason to believe you have been involved in academic dishonesty, you will be referred to the Office of Student Conduct. You will be given the opportunity to review the charge(s). If you believe you are not responsible, you will have the opportunity for a hearing. You should consult with me if you are uncertain about an issue of academic honesty prior to the submission of an assignment.