Philosophy 3300: Advanced Philosophy of Science (Winter 2027)

Chris Smeenk

Instructor Information

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Meeting times and location: TBD

Course Description

This advanced course in the philosophy of science develops a single, sustained line of argument concerning the nature of the evidence for scientific knowledge, and the epistemic status that evidence can support for theories and other substantive claims. How should we define success in evaluating theories, and what does success imply regarding the appropriate stance to take towards, for example, unobservable entities introduced by the theory? The course pursues this question through a detailed critical assessment of the contemporary scientific realism debate, starting from the argument that success is evidence of truth; considering historical and logical challenges to that inference; and considering the range of positions that philosophers have explored. The last part of the course turn to related questions regarding scientific models and idealization. Scientific practice often proceeds by using toy models or simplifications, which deliberately mis-represent or simplify the system being studied. Idealization and modeling presents a distinct challenge to any straightforward inference from success to truth: what kind of conclusions can we draw from the success of simplified models? Throughout the course, the emphasis is on reconstructing and critically assessing rival positions and the arguments that motivate them.

Topics and Readings

The one required book is Paul Dicken, *A Critical Introduction to Scientific Realism* (London: Bloomsbury Academic, 2016), which we will rely on for the first part of the course. This book will be supplemented by selected chapters from Juha Saatsi, ed., *The Routledge Handbook of Scientific Realism* (Routledge, 2018), and article-length readings listed below, will be posted to the Brightspace website. I recommend Peter Godfrey-Smith's *Theory and Reality: An Introduction to the Philosophy of Science*, 2nd ed. (University of Chicago Press, 2021), or Michael Strevens's *The Knowledge Machine* (New York: Liveright / WW Norton, 2020), as background texts.

The course falls into two parts, described below along with their associated readings.

1. *Scientific Realism*: What is the nature, scope, and limit of scientific knowledge, given the character of the evidence we can actually gather and the nature of scientific practice? Drawing primarily on Dicken's textbook, we will focus primarily

on epistemic questions related to the realism debate. We begin with the intuitively compelling argument that predictive success provides evidence of truth (the so-called "no-miracles argument"), then take up the historical and logical challenges to that inference (the pessimistic meta-induction and underdetermination). Within the last twenty years philosophers have explored a number of responses to these arguments, leading to a family of *selective* strategies that try to save realism by retreating to the parts of a theory genuinely responsible for its success, as well as ``anti-realist'' alternatives. We will finally consider whether the debate as usually pursued is even well-posed.

- Dicken, *A Critical Introduction to Scientific Realism* (entire).
- Handbook (selected chapters): Psillos, "The realist turn in the philosophy of science"; Tulodziecki, "Underdetermination"; Chakravartty, "Realism, Antirealism, Epistemic Stances, and Voluntarism"; Massimi, "Perspectivism." *(Optional:* Saatsi, "Realism and the limits of explanatory reasoning.")
- Laudan, "A Confutation of Convergent Realism" (1981).
- Psillos, *Scientific Realism: How Science Tracks Truth* (Routledge, 1999), selections (the "divide et impera" move; deployment realism).
- Vickers, "Scientific Realism and the Stratagema de Divide et Impera" (*British Journal for the Philosophy of Science*, 2006).
- Hacking, *Representing and Intervening* (Cambridge, 1983), selection (entity realism).
- Worrall, "Structural Realism: The Best of Both Worlds?" (1989).
- Ladyman, "What Is Structural Realism?" (1998).
- van Fraassen, *The Scientific Image* (Oxford, 1980), Chapter 2.

2. *Models and Idealization*: Our most successful sciences are shot through with deliberate falsehoods (or fictions): idealized models that misdescribe the systems they represent. If good models are strictly false, what becomes of the realist's inference from success to truth — and of the idea that scientists aim at finding true theories at all? We take up three responses to this puzzle, running from anti-realist through reconciliatory to a rethinking of the aims of science, and reflect on how these considerations augment and complicate the earlier discussion of realism.

- Cartwright, "Do the Laws of Physics State the Facts?", in *How the Laws of Physics Lie* (Oxford, 1983).

- Strevens, "How Idealizations Provide Understanding," in Grimm, Baumberger & Ammon, eds., *Explaining Understanding* (Routledge, 2017), 37–49.

- Potochnik, *Idealization and the Aims of Science* (University of Chicago Press, 2017), selections.

- *(Optional)* Weisberg, "Three Kinds of Idealization" (*Journal of Philosophy*, 2007).

Schedule

The schedule below gives a preliminary week-by-week breakdown. Readings should be completed *before* the first meeting of the week in which they appear. More detailed reading assignments and discussion questions will be posted on Brightspace as the term progresses.

Week 1 — Framing the Question

The epistemic status of scientific theories; what the realism debate is really about; the observable/unobservable distinction; realism, anti-realism, and instrumentalism.

Readings: Dicken, Introduction & ch. 1; short selection from ch. 2. *(Optional orientation:* Chakravartty, "Scientific Realism," Stanford Encyclopedia of Philosophy.)

Week 2 — The No-Miracles Argument

Success as evidence of truth; inference to the best explanation as the engine of realism.

Readings: Dicken, ch. 3; Handbook: Psillos, "The realist turn in the philosophy of science." *(Optional:* Saatsi, "Realism and the limits of explanatory reasoning.")

Week 3 — The Pessimistic Meta-Induction

The historical challenge: successful past theories now judged false.

Readings: Dicken, ch. 4; Laudan, "A Confutation of Convergent Realism."

Week 4 — Underdetermination

Empirical equivalence and unconceived alternatives: the second major challenge to the success–truth inference.

Readings: Handbook: Tulodziecki, "Underdetermination." *(Optional:* Stanford, *Exceeding Our Grasp*, selection.)

Week 5 — Selective Realism: Deployment Realism

The divide-and-conquer response to the meta-induction: believe only the constituents responsible for a theory's success. Psillos's criterion.

Readings: Dicken, ch. 5; Psillos, *Scientific Realism: How Science Tracks Truth*, selections ("divide et impera"; deployment realism).

Week 6 — Selective Realism II: Entity Realism and the Historical Test

Realism about entities rather than theories; whether the selective strategy actually survives the historical record.

Readings: Hacking, *Representing and Intervening* (selection, entity realism); Vickers, "Scientific Realism and the Stratagema de Divide et Impera."

Week 7 — Structural Realism

Preserving structure across theory change; "the best of both worlds" between the no-miracles argument and the meta-induction.

Readings: Dicken, ch. 6; Worrall, "Structural Realism: The Best of Both Worlds?"

Week 8 — Structural Realism II

From knowing-only-structure to structure-as-fundamental; relations without relata.

Readings: Ladyman, "What Is Structural Realism?" *(Optional:* relevant Handbook chapter on structural realism.)*

Week 9 — Constructive Empiricism

Van Fraassen's alternative: empirical adequacy vs. truth; acceptance vs. belief.

Readings: Dicken, ch. 7; van Fraassen, *The Scientific Image*, ch. 2 (selection).

Week 10 — Reframing the Debate

Is the realism question well-posed? Epistemic stances and voluntarism; perspectivism.

Readings: Dicken, Conclusion; Handbook: Chakravartty, "Realism, Antirealism, Epistemic Stances, and Voluntarism"; Massimi, "Perspectivism."

Week 11 — Idealization and the Laws

Do our best laws and models state the facts? Models as the locus of truth; anti-fundamentalism.

Readings: Cartwright, "Do the Laws of Physics State the Facts?"

Week 12 — Idealization and Understanding

How can deliberate falsehoods be epistemically beneficial? Idealizations as flags for non-difference-makers.

Readings: Strevens, "How Idealizations Provide Understanding."

Week 13 — The Ubiquity of Idealization and the Aims of Science

Rampant, unchecked idealization; understanding over truth — and how this impacts the realism debate.

Readings: Potochnik, *Idealization and the Aims of Science* (selections).

Note: I will post more detailed information regarding readings and topics for specific class meetings on Brightspace as the course progresses.

Course-Level Learning Outcomes

This is an advanced course, and it has three main objectives. First, students will gain a detailed understanding of one sustained debate in contemporary philosophy of science regarding the nature, scope, and limits of scientific knowledge, together with the family of positions philosophers have developed and the challenge that the use of idealizations poses to it. Second, students will develop their ability to reconstruct and critically evaluate sophisticated philosophical arguments, to identify the assumptions on which rival positions depend, and to trace how a single line of argument develops across a body of literature. Third, the written work for the course will help students to stake out and defend their own positions on these questions in clear, rigorous, and well-argued prose.

Assessment

1. Attendance and participation (10%)

2. Papers (60%): two papers of roughly 1400–1600 words. Rubrics, suggested topics, and detailed guidelines will be distributed as the term progresses. The late penalty is 3% per work day and 5% for the weekend, with a maximum penalty of 20%. Supporting documentation is required for accommodation for this assessment.

3. Final exam (30%): cumulative essay exam.

Regarding the essays, students are required to share their research and writing process, which will be an integral part of the assessment. Students will be required to write the papers in a fashion that supports assessment of the full process, to ensure that academic integrity can be upheld in line with the policies below. (More information will be provided about this process at the appropriate time. This may include, for example, writing the paper in a dedicated computer lab, or using software that provides transparency regarding authorship.)

Late submissions: The short formative assessments are integrated with the coursework, and it is essential to keep pace and meet deadlines. These are flexible assessments: we will not accept late work, but we will automatically drop the lowest score (the mark for short assignments will be based on the top 8 out of 9).

Statement on the use of Generative AI

In this course, students are permitted to use AI tools exclusively for information gathering and preliminary research purposes. These tools, if used appropriately, can enhance the learning experience by providing access to diverse information sources. However, it is essential that students critically evaluate the outputs and use of this tool, exercise independent thinking, and engage in original research to synthesize and develop their own ideas, arguments, and perspectives. The use of AI tools can serve as a starting point for exploration; however, students are expected to uphold academic integrity by appropriately attributing all sources and avoiding plagiarism. Assignments should reflect the students' own thoughts and independent written work. By adhering to these guidelines, students contribute to a responsible and ethical learning environment that promotes critical thinking, independent inquiry and allows them to produce original written contributions.

If plagiarism or unauthorized AI use is suspected, the instructor may review information regarding the writing process, and may also review research notes and other relevant materials after the assignment has been submitted. If the students use generative AI tools, these research records must include a transcript of their interactions with the LLM or other tool they have used. Students must keep all notes and first drafts until the assignment is returned to them.

Departmental Policies

The Department of Philosophy policies that govern the conduct, standards, and expectations for student participation in Philosophy courses are available in the Undergraduate section of the *Department of Philosophy website*. It is your responsibility to understand the policies set out by the Senate and the Department of Philosophy, and thus ignorance of these policies cannot be used as grounds of appeal.

Audit

Students wishing to audit the course should consult with the instructor prior to or during the first week of classes.

Accommodation

Students seeking academic accommodation on medical grounds for any missed tests, exams, participation components and/or assignments worth 10% or more of their final grade must apply to the Academic Counselling office of their home Faculty and provide documentation. Academic accommodation cannot be granted by the instructor or department. Documentation shall be submitted, as soon as possible, to the Office of the Dean of the student's Faculty of registration, together with a request for relief specifying the nature of the accommodation being requested. The UWO Policy on Accommodation for Medical Illness and further information regarding this policy can be found here.

The Student Medical Certificate is available here.

Academic Consideration

Students may request academic consideration in cases of extenuating circumstances — that is, personal circumstances beyond the student's control that have a substantial but temporary impact on the student's ability to meet essential academic requirements.

1. Requests for academic consideration are made to the Academic Advising office of Faculty in which the student is registered.

2. Requests for academic consideration include the following components:

    a. Self-attestation signed by the student;

    b. Indication of the course(s) and assessment(s) relevant to the request;

    c. Supporting documentation as relevant

Requests without supporting documentation are limited to one per term per course.

Documentation for medical illness, when required, includes the completion of a Western Student Medical Certificate (SMC) or, where that is not possible, equivalent documentation, by a health care practitioner. Requests linked to examinations scheduled by the Office of the Registrar during official examination periods as well as practice laboratory and performance tests typically scheduled in the last week of term always require formal supporting documentation.

Policy on Academic Consideration — Undergraduate Students in First Entry Programs

Religious Accommodation

Western's Policy on Accommodation for Religious Holidays can be found here. In the case of mid-term tests, notification is to be "given in writing to the instructor as early as possible, but not later than one week prior to the writing of the test."

Course Assignment

The last day of scheduled classes in any course will be the last day on which course assignments will be accepted for credit in a course. Instructors will be required to return assignments to students as promptly as possible with reasonable explanations of the instructor's assessment of the assignment.

Scholastic Offences

Scholastic offences are taken seriously, and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site.

Statement on the use of plagiarism-checking software

All required papers may be subject to submission for textual similarity review to the commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between The University of Western Ontario and Turnitin.com.

Academic Advising

Your Home Faculty's Academic Advising Office will support or refer whenever you have an issue that is affecting your studies, including information on adding/dropping courses, academic considerations for absences, appeals, exam conflicts, and many other academic related matters. Do not hesitate to reach out to them if you are struggling and unsure where to go for help. Contact info for all Faculties is here.

Mental Health Support

Students who are in emotional/mental distress should refer to Mental Health@Western for a complete list of options about how to obtain help. Immediate help in the event of a crisis can be had by phoning 519.661.3030 (during class hours) or 519.433.2023 after class hours and on weekends (24/7 availability).

Gender-based and Sexual Violence

Western University is committed to reducing incidents of gender-based and sexual violence (GBSV) and providing compassionate support to anyone who is going through or has gone through these traumatic events. If you are experiencing or have experienced GBSV (either recently or in the past), you will find information about support services for survivors, including emergency contacts at the following website: link. To connect with a case manager or set up an appointment, please contact support@uwo.ca.