

WESTERN UNIVERSITY
DEPARTMENT OF PHILOSOPHY
Graduate Course Syllabus 2020-21
Philosophy 9213B

Philosophy of Scientific Experimentation

Winter Term 2020-21

Zoom lectures (synchronous):

Thursdays, 2:30-4:30 p.m.

(Lectures will be recorded)

Instructor: Jackie Sullivan

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Office Hours: Mon. & Wed. 4-5 p.m.

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Description

Science advances our understanding of the world and ourselves primarily by means of experimentation. Yet, what is an experiment? How do experiments differ across different areas of science? How do experiments produce knowledge? Are experiments always knowledge-generating? What differentiates a successful experiment from an unsuccessful experiment? Answering these questions by exploring historical, philosophical and theoretical analyses of experimentation in the physical, biological and mind-brain sciences will be the primary aims of this course.

Texts

The texts for this course will consist of philosophical and scientific journal articles that are accessible through Western's library system and will be made available via Dropbox as PDFs.

Requirements

50% - Research Paper (3500-4500 words)

15% - In-class presentation via Zoom (on one assigned reading)

15% - In-class presentation via Zoom (on research paper topic)

20% - Attendance & Participation (clear demonstration of having read the assigned readings during discussions on Zoom)

All students will be required to write a research paper that will be due at the end of the term. Each student is also required to do two in-class presentations. The primary aim of the first presentation is to present the key ideas from one of the assigned readings and to raise questions about the assigned readings for discussion. The purpose of the second presentation will be to provide a 10 min presentation of the final research paper topic. As the course will be conducted as a seminar, registered students and auditors are expected to attend the Zoom sessions prepared to discuss the assigned readings.

Rules for auditors

If you plan to take this course for credit as an auditor you are required to do one in-class presentation and miss no more than 5 of the lectures.

DEPARTMENT OF PHILOSOPHY POLICIES

The **Department of Philosophy Policies** which govern the conduct, standards, and expectations for student participation in Philosophy courses is available in the

Undergraduate section of the Department of Philosophy website at <http://uwo.ca/philosophy/undergraduate/policies.html>.

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.

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 at http://uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_medical.pdf.

SELF- REPORTED ABSENCE FORM

Students who experience an unexpected illness or injury or an extenuating circumstance (48 hours or less) that is sufficiently severe to temporarily render them unable to meet academic requirements (e.g., attending lectures or labs, writing tests or midterm exams, completing and submitting assignments, participating in presentations) should self-declare using the online Self-Reported Absence portal. This option should be used in situations where the student expects to resume academic responsibilities within 48 hours or less.

The following conditions are in place for self-reporting of medical or extenuating circumstances:

http://westerncalendar.uwo.ca/PolicyPages.cfm?Command=showCategory&PolicyCategoryID=1&SelectedCalendar=Live&ArchiveID=#SubHeading_322

EVALUATION OF ACADEMIC PERFORMANCE

At least three days prior to the deadline for withdrawal from a course without academic penalty, students will receive assessment of work accounting for at least 15% of their final grade. For 3000- or 4000-level courses in which such a graded assessment is impracticable, the instructor(s) must obtain an exemption from this policy from the Dean and this exemption must be noted on the corresponding course syllabus. In rare instances and at the Dean's discretion, other courses could receive a similar exemption, which also must be noted in the course syllabus.

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.

ACADEMIC 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:

http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf

PLAGIARISM CHECKING

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 <http://www.turnitin.com>.

SUPPORT SERVICES

Registrarial Services <http://www.registrar.uwo.ca>

Student Support Services <https://student.uwo.ca/psp/heprdweb/?cmd=login>

Services provided by the USC <http://westernusc.ca/services/>

Student Development Centre <http://www.sdc.uwo.ca/>

Students who are in emotional/mental distress should refer to Mental Health@Western <http://www.uwo.ca/uwocom/mentalhealth/> 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.

Tentative Schedule of Classes
(Reading selections may change)

January 7 – Course Introduction No readings are due, but here are some suggestions for background reading:

- Experiment in Physics: <https://plato.stanford.edu/entries/physics-experiment/> (Allan Franklin and Slobodan Perovic)
- Experiment in Biology: <https://plato.stanford.edu/entries/biology-experiment/> (Marcel Weber)
- Scientific Method: <https://plato.stanford.edu/entries/scientific-method/> (Hanne Andersen & Brian Hepburn)
- Scientific Discovery: <https://plato.stanford.edu/entries/scientific-discovery/> (Jutta Schickore)
- Deborah Mayo (1994) The New Experimentalism, Topical Hypotheses, and Learning from Error. *Philosophy of Science* 1: 270-279.
- Uljana Feest and Frederick Steinle, “Experiment” from OUP
- Introduction to Lena Soler’s book on *Robustness*

January 14 – Underdetermination – Can evidence from experiments be used conclusively to refute a scientific theory? Is there such a thing as “a crucial experiment”? Is it legitimate to accept a theory as objectively true just so long as it is consistent with the available evidence?

- Pierre Duhem “Physical Theory and Experiment” (1954) [from Curd & Cover 2nd edition 2013]
- Donald Gilles “The Duhem Thesis and the Quine Thesis” (1993) *Philosophy of Science in the Twentieth Century* (Oxford: Blackwell) [from Curd & Cover 2nd edition 2013]

January 21 – Experimentation and Realism – What is the relationship between phenomena “created” in the laboratory and phenomena occurring in the world? Does the ability to manipulate entities under controlled conditions of laboratory legitimate the conclusion that those entities are real?

- Ian Hacking (1984), “Experimentation and Scientific Realism” [from Curd & Cover 2nd Edition 2013, 1140-1155].
- David B. Resnik (1994), “Hacking’s Experimental Realism” [from Curd & Cover 2nd Edition 2013, 1156-1171].

January 28 – Data, Phenomena & Observability – What is the relationship between data and claims about phenomena that data are used to substantiate? Do we see phenomena directly or only indirectly? What about data?

- James Bogen and James Woodward (1988), “Saving the Phenomena” *Philosophical Review* 97 (3): 303-352. [selected pages of article]
- Hasok Chang (2005), “A Case for Old-Fashioned Observability, and a Reconstructed Constructive Empiricism” *Philosophy of Science* 72: 876-887.

- Sabina Leonelli (2009), “On the Locality of Data and Claims about Phenomena”, *Philosophy of Science* 76: 737-749. [This paper may be replaced by a more recent paper by Leonelli on how data travels]

February 4 – Measurement & the Experimenter’s Regress- When new entities are postulated in science and the available technology is insufficient for detecting those entities, when can an investigator be certain to have developed a reliable detection technique and how can he/she measure the reliability and accuracy of these detection techniques without falling victim to circular reliance on the detection technique itself (i.e., experimenter’s regress)?

- Allan Franklin (1994) “The Experimenter’s Regress”, *Studies in the History and Philosophy of Science*, Vol. 25, No. 3, pp. 463-491.
- Collins, H.M. (1994) “The Experimenter’s Regress”, *Studies in the History and Philosophy of Science*, Vol. 25, No. 3, pp. 493-503.

February 11 – Reliability, Robustness & Error – When does an investigator have good grounds for believing that the data production process is reliable and that the data may be used to ground theoretical claims? Are multiple detection techniques required? Is one trial as good as a hundred?

- Cartwright, N. (1991). Replicability, reproducibility and robustness: Comments on Harry Collins. *History of Political Economy* 23, 143-155.
- William Wimsatt, “Robustness, Reliability and Overdetermination” in *Re-engineering philosophy for Limited Beings* (Harvard University Press 2007)
- Schickore, J. (2005). Through thousands of errors we reach the truth’ --but how? On the epistemic roles of error in scientific practice. *Studies in History and Philosophy of Science Part A* 36(3): 539-556.

February 18 – Reading week – NO CLASS

February 25 – Types of Validity – When can an investigator be certain that the type of phenomenon he/she is trying to measure is actually the one detected in the laboratory (construct validity)? Can an investigator be certain that conclusions reached in the context of the laboratory are legitimately applicable to the real world (external validity)?

- Francesco Guala (2003) “Experimental Localism and External Validity” *Philosophy of Science* 70: 1195-1205.
- Cronbach, L. and Meehl, P. E. (1955). Construct validity in psychological tests. *Psychological Bulletin* 52, 281-302. [Taken from A Paul Meehl Reader]

March 4 – Extrapolation across the sciences. Can an investigator be certain that conclusions reached in the context of the laboratory are legitimately applicable to the real world (external validity)?

- Daniel Steel (2010), “A New Approach to Argument by Analogy: Extrapolation and Chain Graphs”, *Philosophy of Science* 77(5) : 1058-1069.
- Francesco Guala (2010), “Extrapolation, Analogy, and Comparative Process Tracing”, *Philosophy of Science* 77(5): 1070-1082.

- Wendy Parker (2010), “Comparative Process Tracing and Climate Change Fingerprints” *Philosophy of Science* 77(5): 1083-1095.

March 11 - Exploratory Experiments - Not all experiments involve hypothesis testing; some experiments are instead *exploratory*. Yet, what does this mean? How do exploratory experiments differ from hypothesis-driven experiments? What role do exploratory experiments play in science?

- Frederic Steinle (1997), “Entering New Fields: Exploratory Uses of Experimentation” *Philosophy of Science* 64: S65-S74.
- Laura Franklin (2005) “Exploratory Experiments”, *Philosophy of Science* 72: 888-899.

March 18 – Null-hypothesis testing – Are there differences between physics and other areas of science in terms of the kinds of errors that arise that may negatively impact hypothesis testing and data interpretation? Are values more prone to enter some areas of science rather than others?

- Douglas, H. (2000). Inductive risk and values in science. *Philosophy of Science* 67, 559-579.

March 25 – Types of Experiments: Simulations – Can computer simulations be used to arrive at true claims about the world? Are simulations really experiments? If they are experiments, are they on an epistemic par with experiments that involve material interventions?

- Mary S. Morgan, (2003), “Experiments without Material Intervention: Model Experiments, Virtual Experiments and Virtually Experiments” In H. Radder (Ed.), *The philosophy of scientific experimentation*.
- Wendy Parker (2009), “Does Matter Really Matter? Computer Simulations, Experiments and Materiality”, *Synthese* 169: 483-496.
- Emily Parke (2014), Experiments, Simulations and Epistemic Privilege. *Philosophy of Science*, Vol. 81 (4): 516-536.

April 1 – In-class presentations – The aim of these presentations is to provide students with an opportunity to get feedback on their ideas for papers from their peers.