PHILOSOPHY OF SCIENCE (HONOURS) (PHIL10149)

COURSE ORGANISER: Dr. Jamie Collin (james.collin@ed.ac.uk)

COURSE SECRETARY: Miss Ann-Marie Cowe (philinfo@ed.ac.uk)

SEMINAR TIME AND LOCATION: 16:10–18:00, 7 George Square, S1.

TUTORIAL TIMES AND LOCATIONS: TBC

COURSE AIMS AND OBJECTIVES

This is a level 10 course aimed at 3rd-year students covering key topics in contemporary philosophy of science, including: scientific expertise, laws of nature, logical positivism, Bayesian confirmation theory, scientific modelling and representation, measurement, scientific explanation, scientific realism, and postmodern understandings of science.

LEARNING OUTCOMES

On completion of this course, the student will be able to:

1. To provide students with a well rounded view of central issues in Philosophy of Science, and to expand their knowledge beyond the set pre-Honour course.
2. To enhance their communication skills by developing pedagogical materials on assigned readings (which will be marked as the class participation part of the assessment for this course).

REQUIREMENTS AND ASSESSMENTS

This course will be assessed through class participation (10%), a mid-term essay of 1,500 words (40%), and an end-of-semester essay of 2,000 words (50%).

READINGS

In completing this course you will learn to become effective researchers. To this end, while we supply readings each week, it's up to you to conduct your own research and seek out further secondary sources that will aid you in understanding these difficult topics.
Three sources may be particularly useful:

The Internet Encyclopedia of Philosophy.

This provides introductory encyclopaedia articles, written by experts, on many topics in philosophy. As well as providing a useful introduction to the topics at hand, the readings lists at the bottom of each article can be used to guide further research. The IEP is freely accessible online.

The Stanford Encyclopedia of Philosophy.

Like the IEP, the SEP also provides encyclopeadia articles, written by experts, on many topics in philosophy. These tend to be slightly longer and more detailed, but also more difficult, than IEP entries. As before, the reference list at the bottom of each article can be used to guide further research. The SEP is freely accessible online.

Oxford Bibliographies

Oxford Bibliographies provides research guides in the form of annotated bibliographies compiled by experts in their given field. This is available online through the library tab in MyEd.

SYLLABUS

Week 1 | Scientific expertise, testimony, and trust

Scientific practice requires trusting the testimony of other scientists, for instance in believing that the results published in scientific journals are being truthfully reported. Moreover, public and private institutions rely on the testimony of scientific experts in myriad ways. This raises a number of epistemological questions – What makes someone an expert? Are there reliable ways that laypeople can differentiate between genuine and mere purported experts? Are there any occasions where we are warranted in not believing expert testimony? – which are explored here.

Essential reading:

Scholz, O. (2018). Symptoms of Expertise: Knowledge, Understanding and Other Cognitive Goods. *Topoi*, *37*(1), 29–37. https://doi.org/10.1007/s11245-016-9429-5

Monya Baker. (2016). 1,500 scientists lift the lid on reproducibility. *Nature*, *533*(7604), 452–454. https://doi.org/10.1038/533452a

Further reading:

Alexander Bird. (n.d.). Understanding the Replication Crisis as a Base Rate Fallacy. *The British Journal for the Philosophy of Science*. Retrieved from https://doi.org/10.1093/bjps/axy051

Whyte, K., & Crease, R. (2010). Trust, expertise, and the philosophy of science. *Synthese*, *177*(3), 411–425. https://doi.org/10.1007/s11229-010-9786-3

Goldman, A. I. (2001). Experts: Which Ones Should You Trust? *Philosophy and Phenomenological Research*, *63*(1), 85–110. https://doi.org/10.1111/j.1933-1592.2001.tb00093.x

Jones, W. (2002). Dissident versus Loyalist: Which Scientists Should We Trust? *The Journal of Value Inquiry*, *36*(4), 511–520. https://doi.org/10.1023/A:1021945707032

Week 2 | Laws of nature (part I)

The Scientific Revolution – and the new mathematical means of representing the physical world that precipitated it – fundamentally altered the way we understand reality. The Aristotelian picture which had been dominant for two millennia was overthrown, with ripple-out implications for much philosophical thought. Here we consider this transition, as well as contemporary and scientifically-informed revivals of Aristotelian metaphysical ideas.

Essential reading:

Cartwright, N. (1997). Where Do Laws of Nature Come From?*. *Dialectica*, *51*(1), 65–78. https://doi.org/10.1111/j.1746-8361.1997.tb00021.x

Henry, J. (2008). *The scientific revolution and the origins of modern science* (Third edition.). Basingstoke: Palgrave Macmillan. Chapters 3 and 5.

Further reading:

Armstrong, D. M. (David M. (2016). *What is a law of nature?* (Cambridge philosophy classics edition..). Cambridge: Cambridge University Press.

Fraassen, B. C. V. (1993). Armstrong, Cartwright, and Earman on "Laws and Symmetry." *Philosophy and Phenomenological Research*, *53*(2), 431–444.

Beebee, H., Hitchcock, C., Menzies, P., Mumford, S., Beebee, H., Hitchcock, C., … Mumford, S. (2009). Causal Powers and Capacities. In H. Beebee, C. Hitchcock, P. Menzies, & S. Mumford (Eds.), *The Oxford Handbook of Causation* (1st ed.). Oxford University Press. https://doi.org/10.1093/oxfordhb/9780199279739.003.0013

Week 3 | Laws of nature (part II)

Since at least the time of David Hume, some empiricist philosophers have criticized both the idea that we could know the behaviour of the physical world was governed by causal powers or natural laws, and the very intelligibility of the concepts of causation and natural necessity. This week we examine arguments for and against empiricism.

Essential reading:

Beebee, H. (2000). The non-governing conception of laws of nature (Ramsey-Lewis theory, thought experiments). *Philosophy And Phenomenological Research*, *61*(3), 571–594. https://doi.org/10.2307/2653613

Foster, J. (1983). Induction, Explanation and Natural Necessity. *Proceedings of the Aristotelian Society*, *83*, 87–.

Further reading:

Mumford, S. (2004). *Laws in nature*. London ; New York: Routledge.

Week 4 | Logical Positivism

Logical positivism – partly inspired by Humean empiricist scruples – was perhaps *the* dominant philosophical movement in the early 20th century. The logical positivists were technically sophisticated and scientifically informed, drawing on recent developments in the foundations of mathematics and in physics to expound a view of philosophy that attempted to do these things justice. The result was a dramatic rethinking of philosophy in terms of 'language management' and a rejection of traditional metaphysical questions. Logical positivism has since fallen largely out of favour with the philosophical world, but is also winning new adherents. In this lecture we consider the motivations for logical positivism, the character of logical positivism, and the status of positivism today.

Essential reading:

Moore, A. W. (2011). *The Evolution of Modern Metaphysics : Making Sense of Things*. Cambridge: Cambridge University Press. Chapter 11.

Further reading:

Friedman, M. (1999). *Reconsidering Logical Positivism*. Cambridge: Cambridge University Press. Richard Creath. (n.d.). Logical Empiricism. In Edward Zalta (Ed.), *Stanford Encyclopedia of Philosophy*. Retrieved from https://plato.stanford.edu/entries/logical-empiricism/

Mauro Murzi. (n.d.). Rudolf Carnap. Retrieved from https://www.iep.utm.edu/carnap/

Blatti, S., & Lapointe, S. (2016). *Ontology after Carnap* (First edition..). Oxford: Oxford University Press.

Creath, R., & Friedman, M. (2008). *The Cambridge companion to Carnap*. Cambridge: Cambridge University Press.

Richardson, A. W., & Uebel, T. E. (Thomas E. (2008). *The Cambridge companion to logical empiricism*. Cambridge: Cambridge University Press.

Week 5 | Bayesian Confirmation Theory

While scientific theories cannot generally be proven – in the strong, mathematical sense – some are well *confirmed* by evidence (setting aside radical skepticism), while others are not. What it means to be confirmed by evidence is a tricky philosophical question, as attested to by the history of failed theories of scientific confirmation. Bayesian confirmation theory avoids many of these pitfalls, but raises questions of its own, discussed in this week.

Essential reading:

Swinburne, Richard (2001). *Epistemic Justification*. Oxford: Clarendon Press. Chapters 3 and 4.

Further reading:

Strevens, M. (2012). *Notes on Bayesian Confirmation Theory*. Retrieved from http://www.nyu.edu/classes/strevens/BCT/BCT.pdf

Branden Fitelson. (2007). Likelihoodism, Bayesianism, and Relational Confirmation. *Synthese*, *156*(3), 473–489. Retrieved from http://www.jstor.org.ezproxy.is.ed.ac.uk/stable/27653530

Patrick Maher. (1996). Subjective and Objective Confirmation. *Philosophy of Science*, *63*(2), 149–174. Retrieved from http://www.jstor.org.ezproxy.is.ed.ac.uk/stable/188467?seq=1#page_scan_tab_contents

Carnap, R. (2011). In *Philosophy of probability: contemporary readings* (Vol. Routledge contemporary readings in philosophy). Routledge.

Week 6 | Scientific Modelling and Representation

Scientific modelling is central to many areas of science, but raises many philosophical questions. How can looking at one thing (the model) tell us about something else (the world)? More generally, what is required for scientific representation (and representation *simpliciter*)? How do idealisations function in models? How can a deliberately *in*accurate model of the world represent and explain features of reality?

Essential reading:

Knuuttila, T. (2011). Modelling and representing: An artefactual approach to model-based representation. *Studies in History and Philosophy of Science Part A*, *42*(2), 262–271. https://doi.org/10.1016/j.shpsa.2010.11.034

Further reading:

Michael Weisberg. (2007). Who Is a Modeler? *The British Journal for the Philosophy of Science*, *58*(2), 207–233. Retrieved from http://www.jstor.org.ezproxy.is.ed.ac.uk/stable/30115224?seq=1#page_scan_tab_contents

Godfrey-Smith, P. (2006). The strategy of model-based science. *Biology and Philosophy*, *21*(5), 725–740. https://doi.org/10.1007/s10539-006-9054-6

Isaac, A. M. C. (2012). Modeling without representation. *Synthese*, *190*(16), 1–13. https://doi.org/10.1007/s11229-012-0213-9

Levins, R., & Richard Levins. (1966). THE STRATEGY OF MODEL BUILDING IN POPULATION BIOLOGY. *American Scientist*, *54*(4), 421–431.

Morgan, M. S., & Morrison, M. (1999). *Models as mediators : perspectives on natural and social sciences*. Cambridge: Cambridge University Press.

Parker, W. S. (2011). When Climate Models Agree: The Significance of Robust Model Predictions*. *Philosophy of Science*, *78*(4), 579–600. https://doi.org/10.1086/661566

Potochnik, A. (2012). Feminist implications of model-based science. *Studies in History and Philosophy of Science Part A*, *43*(2), 383–389. https://doi.org/10.1016/j.shpsa.2011.12.033

Weisberg, M. (2007). Three Kinds of Idealization. *The Journal of Philosophy*, *104*(12), 639–659. https://doi.org/10.5840/jphil20071041240

Weisberg, M. (2013). *Simulation and similarity using models to understand the world*. New York: Oxford University Press.

Morrison, M. (2015). *Reconstructing Reality: Models, Mathematics, and Simulations*. Oxford University Press. https://doi.org/10.1093/acprof:oso/9780199380275.001.0001

Week 7 | Measurement

Measurement is the mysterious process by which it becomes possible to represent physical systems mathematically. Without measurement, science would be impossible, but measurement is the source of a number of philosophical puzzles. For instance, measurement seems to involve a kind of circularity: measurements are only meaningful in the context of an antecedent theory, but are also supposed to lend empirical support to theories. The philosophy of measurement also interacts with the issues surrounding scientific realism in deep and illuminating ways.

Essential reading:

Tal, E. (2013). Old and New Problems in Philosophy of Measurement. *Philosophy Compass*, *8*(12), 1159–1173. https://doi.org/10.1111/phc3.12089

Further reading:

Morrison, M. (2009). Models, measurement and computer simulation: the changing face of experimentation. *Philosophical Studies*, *143*(1), 33–57. https://doi.org/10.1007/s11098-008-9317-y

Chang, H. (2004). *Inventing Temperature: measurement and scientific progress*. Oxford: Oxford University Press.

Domotor, Z., & Batitsky, V. (2008). The Analytic Versus Representational Theory of Measurement: A Philosophy of Science Perspective. *Measurement Science Review*, *8*(6), 129–146. https://doi.org/10.2478/v10048-008-0031-x

van Fraassen, B. C. (2012). Modeling and Measurement: The Criterion of Empirical Grounding. *Philosophy of Science*, *79*(5), 773–784. https://doi.org/10.1086/667847

Mari, L. (2005). The problem of foundations of measurement. *Measurement*, *38*(4), 259–266. https://doi.org/10.1016/j.measurement.2005.09.006

Tal, E. (2016). Making Time: A Study in the Epistemology of Measurement. *The British Journal for the Philosophy of Science*, *67*(1), 297–335. https://doi.org/10.1093/bjps/axu037

Teller, P. (2013). The concept of measurement-precision. *Synthese*, *190*(2), 189–202. https://doi.org/10.1007/s11229-012-0141-8

Week 8 | Scientific Explanation

As with the notion of confirmation, the history of the philosophy of science is replete with failed attempts to analyse scientific explanation. Here we explore why deductive-nomological and inductive-statistical accounts of scientific explanation are now widely rejected, and ask whether accounts of scientific explanation in terms of causation or unification fare any better.

Essential reading:

Friedman, M. (1974). Explanation and Scientific Understanding. *The Journal of Philosophy*, *71*(1), 5–19. https://doi.org/10.2307/2024924

Further reading:

Bangu, S. (2017). Scientific explanation and understanding: unificationism reconsidered. *European Journal for Philosophy of Science*, 7(1), 103–126. https://doi.org/10.1007/s13194-016-0148-y

James Woodward. (n.d.). Scientific Explanation. In Edward Zalta (Ed.). Retrieved from https://plato.stanford.edu/entries/scientific-explanation/

G. Randolph Mayes. (n.d.). Theories of Explanation. In James Fieser and Bradley Dowden (Ed.). Retrieved from https://www.iep.utm.edu/explanat/

Khalifa, K. (2017). *Understanding, explanation, and scientific knowledge*. Cambridge: Cambridge University Press.

Baker, A. (2005). Are there genuine mathematical explanations of physical phenomena? *Mind*, *114*(454), 223–238. https://doi.org/10.1093/mind/fzi223

Week 9 | Scientific realism

According to scientific realism, our best science aims at giving us (and succeeds *in* giving us) accurate descriptions of both the observable and the unobservable world. This week we focus on what is often taken to be the foremost argument for scientific realism: the 'no miracles' argument, which centres around the thought that the predictive success of our best scientific theories would be a 'miracle' if they were not at least approximately true. We consider the argument and recent objections to it.

Essential reading:

Chakravartty, A. (n.d.). Scientific Realism. In *Stanford Encyclopedia of Philosophy*. Retrieved from https://plato.stanford.edu/archives/sum2017/entries/scientific-realism/

Dellsén, F. (2016). Explanatory Rivals and the Ultimate Argument. *Theoria*, *82*(3), 217–237. https://doi.org/10.1111/theo.12084

Further reading:

Lyons, T. d. (2003). Explaining the Success of a Scientific Theory. *Philosophy of Science*, *70*(5), 891–901. https://doi.org/10.1086/377375

Laudan, L. (1981). A CONFUTATION OF CONVERGENT REALISM. *Philosophy of Science*, *48*(1), 19–49. https://doi.org/10.1086/288975

Magnus, P. d., & Callender, C. (2004). Realist Ennui and the Base Rate Fallacy. *Philosophy of Science*, *71*(3), 320–338. https://doi.org/10.1086/421536

Week 10 | Science and postmodernism

Kuhn's famous historical-philosophical work on the development of science combined with Kantian anti-realist ideas (via the logical positivists) to produce 'postmodern' understandings of science. These typically asserted that epistemic norms (standards of justification, confirmation etc.) are relative rather than objective, and that the facts uncovered by science are socially constructed rather than mind-independent or objectively "out there" in the world to be found. This week we explore the roots of postmodernism and the arguments both for and against it.

Essential reading:

Haack, S. (1995). Puzzling out science. *Academic Questions*, *8*(2), 20–31. https://doi.org/10.1007/BF02683186

Bloor, D., & Bloor, D. (2011). Relativism and the Sociology of Scientific Knowledge. In *A Companion to Relativism* (pp. 431–455). Wiley-Blackwell. https://doi.org/10.1002/9781444392494.ch22

Further reading:

Putnam, H. (1981). *Reason, Truth and History*. Cambridge: Cambridge University Press. Chapter 3.

Zammito, J. H. (2004). *A nice derangement of epistemes : post-positivism in the study of science from Quine to Latour*. Chicago: The University of Chicago Press.

Brandom, R. (2000). *Rorty and his critics*. Malden, Mass. ; Oxford: Blackwell.

Rorty, R. (1980). *Philosophy and the mirror of nature*. Oxford: Basil Blackwell.

Hales, S. D. (2011). *A companion to relativism*. Chichester: Wiley-Blackwell.

Week 11 | Review Week

No set reading.