Philosophy Faculty Reading List and Course Outline 2018-2019

PART II PAPER 06:
PHILOSOPHY OF SCIENCE

SYLLABUS

- Philosophy of Physics I: the metaphysics of space and space-time: absolute and relational theories of space and space-time; geometry and conventionalism.
- Philosophy of Physics II: the interpretation of quantum mechanics; non-locality.
- Philosophy of Biology: biological kinds, the nature of species; biological laws; functional and causal explanation in biology.
- Philosophy of Economics and Social Science: social science versus natural science; rational choice theory and social science; social ontology.

COURSE OUTLINE

Philosophy of science at Part IB studied philosophical problems that arise when we think about scientific method in general. This Part II focuses on philosophical problems connected with particular branches of science.

Philosophy of Physics concentrates on overlaps between metaphysical questions and those at the foundations of physics, addressing such questions as the reality of space and measurement-independence.

Philosophy of Biology: examines such questions as does biology seek natural kinds, and do kinds have essences? How do biological explanations differ from physical ones? Does any contingency in evolutionary processes undermine biological laws?

Philosophy of Economics and Social Science considers whether these disciplines differ in some basic and interesting way from natural sciences; whether it is appropriate to model human behaviour using the tools of rational choice theory (including ‘game theory’); and whether there is a ‘social reality’ over and above what depends only on individuals.

Special topic (2018-19): Philosophy of Cognitive Science critically examines key research strategies employed in cognitive science, addressing such questions as: What constitutes a good explanation in cognitive science? Is cognition a property of only the brain or does it extend to the body and world?

READING LIST

Readings are divided into (A) and (B) lists below. Some attempt is made to put material in the basic (A)-lists in a sensible reading order. (B)-lists are in alphabetical order, and for dipping into (no-one expects you to read everything).

PHILOSOPHY OF PHYSICS

It is an uplifting experience, for both the spacetime and the quantum parts of the course, to read some philosophical writings by the giants of twentieth-century physics. For example:

EINSTEIN, Albert, 'Autobiographical Notes', in P.A. Schilpp, ed., Albert-Einstein: Philosopher-Scientist. 3rd ed. (La Salle, IL: Open Court, 1970). [this and other essays therein, written in Einstein’s honour, e.g. by N. Bohr]


A historically oriented survey of the philosophy of physics, which is especially strong on the space and time part of the syllabus is:

TORRETTI, Roberto, The Philosophy of Physics (Cambridge: Cambridge University Press, 1999). Also available online at: https://doi.org/10.1017/CBO9781139172981

Space-time and quantum mechanics are both addressed by particle physicists. Their work on gravity embodies conventional wisdom among many physicists, but is insufficiently considered in philosophy. Particle physics provides perspective on substantivalism vs. relationalism and on conventionality and gives a distinctive justification for Einstein’s field equations akin to eliminative induction. The following selections are all short.

GUPTA, Suraj N., 'Einstein’s and Other Theories of Gravitation’, Reviews of Modern Physics, 29 (1957): 334-36.


https://doi.org/10.1016/0370-2693(72)90418-2
PHILOSOPHY OF PHYSICS I

It is well worth reading some accessible introductions to relativity. Note that you do not need a very deep mathematical understanding of the theories in order to engage with the chosen philosophical issues at a Part II level. But on the other hand, you do need some grasp of what is going on in the physics! For helpful introductions to relativity with low mathematical content, see:


Geroch explains the idea of 'space-time' very well, Sartori will tell you a little more about the physics. Those with a mathematical background will find the classic:


Relatively approachable, and Rindler also pays more attention at the outset to the conceptual background than most textbooks. You'll find yards more of books on relativity on library shelves: browse till you find something that suits. A classic on the foundations and history of relativity theory is:


A good introduction to General Relativity that is also aware of the particle physics tradition is:

OHANIAN, Hans, and Remo RUFFINI, Gravitation and Spacetime. 3rd ed. (Cambridge: Cambridge University Press, 2013). Also available online at: https://doi.org/10.1017/CBO9781139003391

Three fairly recent books on cosmology that are worth mentioning are:

HAKIM, Rémi, An Introduction to Relativistic Gravitation (Cambridge: Cambridge University Press, 1999). Also available online at: https://doi.org/10.1017/CBO9781139174213
LIDDLE, Andrew R., An Introduction to Modern Cosmology (Chichester: John Wiley, 1999).

Even a quick browse that ignores the mathematical detail will be quite instructive.

The Metaphysics of Space and Spacetime

Two focal points of debate concern substantivalism and relationism (are all facts about space fixed by the facts about the spatial relations between actual-or-actual-and-possible objects?), and conventionalism about geometry and topology (is the choice of a geometrical framework within which to do physics ultimately a matter of convention?). For either topic you will find the following useful introductory reading:

SKLAR, Lawrence, The Philosophy of Physics (Oxford: Oxford University Press, 1992), ch. 2 'Space, time, and motion'.

A slower, fuller treatment of the issues is to be found in:


The basic 'old' debate between Newton and Leibniz on absolute and relational theories is the topic in particular of Dainton’s chs. 9–11. Historical material about this debate, indeed about the 'history of space' over two millennia, can be found in:


But in this paper, we look at the 'new' debate, as it arises in the context of modern spacetime theories. This debate is also enriched by considering literature from particle physicists, pondering the century-long controversy about gravitational energy and conservation laws in General Relativity, and exploring the claimed absence of change in a formulation of General Relativity perhaps best suited for a merger with quantum mechanics.

Absolute and Relational Theories of Space and Spacetime

For further reading, beyond Dainton, see:

(A)


PITTS, J. Brian, 'Change in Hamiltonian General Relativity from the Lack of a Time-Like Killing Vector Field', *Studies in History and Philosophy of Modern Physics*, 47 (2014): 68-89. [https://doi.org/10.1016/j.shpsb.2014.05.007](https://doi.org/10.1016/j.shpsb.2014.05.007)


**Geometry and Conventionalism**

(A)


DAINTON, Barry, *Time and Space* (Chesham: Acumen, 2010), ch. 13 'Curved space'.


NERLICH, Graham, *The Shape of Space*, 2nd ed. (Cambridge: Cambridge University Press, 1994). Also available online at: [https://doi.org/10.1017/CBO9780511621130](https://doi.org/10.1017/CBO9780511621130).


(B)

BEN-MENAHEM, Yemima, *Conventionalism: From Poincare to Quine* (Cambridge: Cambridge University Press, 2006), ch. 3 'Relationism: from “experience and geometry” to “geometry and experience”'. Also available online at: [https://doi.org/10.1017/CBO9780511584404.004](https://doi.org/10.1017/CBO9780511584404.004)

BROWN, Harvey R., *Physical Relativity: Space-Time Structure from a Dynamical Perspective* (Oxford: Oxford University Press, 2005), ch. 9 'The View from General Relativity'. Also available online at: [https://doi.org/10.1093/0199275831.003.0009](https://doi.org/10.1093/0199275831.003.0009)


PHILOSOPHY OF PHYSICS II

The Interpretation of Quantum Mechanics

We focus on three clusters of issues: why is the old orthodox interpretation of quantum mechanics (apparently) in trouble? What are the prospects for the Everett (many-worlds) interpretation? And how should we respond to non-locality results?

For helpful introductions to Quantum Mechanics with a very low mathematical content, see, for example, the following:


STYER, Daniel F., *The Strange World of Quantum Mechanics* (Cambridge: Cambridge University Press, 2000). Also available online at: https://doi.org/10.1017/CBO9781107050709

The Davies and Brown volume contains a series of interviews with 'big name' physicists who defend differing views of quantum mechanics.


Is written by a philosopher, and proceeds gently, explaining e.g. complex numbers and vectors. Those with a mathematical background who want a straight, non-philosophical, introduction to the physics will find the choice of texts almost limitless. It really is a question of browsing to find a book that suits your mathematical level. One fine short book is:


(B)


CUSHING, James, *Quantum Mechanics: Historical Contingency and the Copenhagen Hegemony* (Chicago, IL: University of Chicago Press, 1994), chs. 2 & 3.


VAN FRAASSEN, Bas C., *Quantum Mechanics: An Empiricist View* (Oxford: Oxford University Press, 1991), chs. 1, 6 & 8. Also available online at: https://doi.org/10.1093/acprof:oso/9780198239807.001.0001

The Everett Interpretation

(A)


(B)


Non-Locality

(A)

BELL, John Stewart, 'Bertlmann's Socks and the Nature of Reality', in his *Speakable and Unspeakable in Quantum Mechanics* (Cambridge: Cambridge University Press, 1987), pp. 139-58. Also available online at: https://doi.org/10.1017/CBO9780511815676.


CUSHING, James T., *Philosophical Concepts in Physics* (Cambridge: Cambridge University Press, 1998), ch. 22 'The EPR paper and Bell's theorem'. Also available online at: https://doi.org/10.1017/CBO9781139171106.


(B)

BUB, Jeffrey, *Interpreting the Quantum World* (Cambridge: Cambridge University Press, 1997), ch. 2 'Bell's 'no go' theorem'.

CUSHING, James, *Quantum Mechanics: Historical Contingency and the Copenhagen Hegemony* (Chicago, IL: University of Chicago Press, 1994), ch. 10 'An alternative scenario?'


**PHILOSOPHY OF BIOLOGY**

**General**

There are two very good introductory texts on philosophy of biology:


There are also several very useful collections of classic articles:

HULL, David, and Michael RUSE, eds., *The Cambridge Companion to the Philosophy of Biology* (Cambridge: Cambridge University Press, 2007). Also available online at: [https://doi.org/10.1017/CCOL9780521861262](https://doi.org/10.1017/CCOL9780521861262)


**Biological Kinds and the Nature of Species**

Two interleaved questions are treated by these readings. First, can standard accounts of the nature and role of natural kinds be applied to biology? More specifically, can they be applied to biological species? Second, what sorts of things are biological species? Is there, for example, any sense in which they have essences?

(A)


ERESHEFSKY, Marc, *The Poverty of the Linnaean Hierarchy* (Cambridge: Cambridge University Press, 2001). Also available online at: [https://doi.org/10.1017/CBO9780511498459](https://doi.org/10.1017/CBO9780511498459)


(B)


**Biological Laws**

On the one hand, physics snobs have sometimes suggested that biology lacks laws, and as a result has the status of mere 'stamp collecting'. On the other hand, philosophers of biology have sometimes argued that only someone with an impoverished view of the sciences would think that it lacks laws. It is worth familiarising yourself with general material on laws of nature prior to looking at these biology-specific pieces.

(A)


(B)


Functional and Causal Explanation in Biology

Most items below concentrate on the puzzling teleological aspect of many biological explanations: dolphins are streamlined because it enables them to swim more efficiently. What is the nature of these explanations? Some of the items also concern the question of whether causal explanation in biology can be understood as a simple instance of causal explanation more generally.

(A)

ALLEN, Colin, Marc BEKOFF, and George LAUDER, eds., *Nature's Purposes* (Cambridge, MA: MIT Press, 1998). [This enormous collection contains a very large number of relevant papers. Focus on those by Cummins, Wright, Neander, Millikan, Griffiths and Godfrey-Smith. The papers by Cummins and Wright are classics, and are reprinted in many other places]


MITCHELL, Sandra D., *Unsimple Truths: Science, Complexity and Policy* (Chicago, IL: University of Chicago Press, 2009), ch. 4 'Science: How we investigate the world'. Also available on Moodle


(B)


PHILOSOPHY OF ECONOMICS AND SOCIAL SCIENCE

Introductory

HOLLIS, Martin, *Philosophy of Social Science: An Introduction* (Cambridge: Cambridge University Press, 1994). Also available online at: [https://doi.org/10.1017/CBO9780521447801]


Many helpful papers are also available in:


Social Science vs. Natural Science

(A)


MILL, John Stuart, *A System of Logic*, Book VI, ch. 3 'That there is, or may be, a science of human nature'. Also available online at: [https://www.gutenberg.org/files/27942/27942-h/27942-h.html]


(B)


BROMBERGER, Sylvain, *On What We Know We Don't Know* (Chicago, IL: University of Chicago Press, 1992).


GILBERT, Margaret, 'The Structure of the Social Atom: Joint Commitment and the Foundation of Human Social Behaviour', in F. Schmitt, ed., *The Practice Turn in Contemporary Theory* (London: Routledge, 2003), pp. 17-28. Also available online at: https://doi.org/10.1017/CBO9780511819025.012


(B)


Social Ontology

(A)


DURKHEIM, Émile, 'Social Facts', in M. Martin and L.C. McIntyre, eds., *Readings in the Philosophy of Social Science* (Cambridge, MA: MIT Press, 1994), ch. 6 'Games with rational agents'. Also available online at: https://doi.org/10.1017/CCOL0521447801


GILBERT, Margaret, 'The Structure of the Social Atom: Joint Commitment and the Foundation of Human Social Behaviour', in F. Schmitt, ed., *Socializing Metaphysics* (Lanham, MD: Rowman and Littlefield, 2003), pp. 39-64. Also available online at: www.dawsonera.com


(B)

CUDD, Ann E., Analyzing Oppression (Oxford: Oxford University Press, 2006). Also available online at: https://doi.org/10.1093/acprof:oso/9780199892631.001.0001


HASLANGER, Sally, Resisting Reality (Oxford: Oxford University Press, 2012). Also available online at: https://doi.org/10.1093/acprof:oso/9780199892631.001.0001


PHILOSOPHY OF COGNITIVE SCIENCE

Special topic (2018-19): Philosophy of cognitive science: folk psychology; eliminative materialism; explanation in psychology and neuroscience; embodied and extended cognition.

General introductory texts

BERMÚDEZ, José Luis, Cognitive Science: An Introduction to the Science of the Mind (Cambridge: Cambridge University Press, 2010). Also available online at: https://doi.org/10.1017/CBO9780511781322


Folk Psychology

(B)

BERMÚDEZ, José Luis, Philosophy of Psychology: A Contemporary Introduction (London: Routledge, 2005).


STICH, Stephen, From Folk Psychology to Cognitive Science: The Case against Belief (Cambridge, MA: MIT Press, 1983), ch. 1 'Two cultures and the promise of cognitive science'.

(B)


Eliminative Materialism

(A)


(B)


Explanation in Psychology and Neuroscience

(A)


(B)


Embodied and Extended Cognition

(A)


We welcome your suggestions for further readings that will improve and diversify our reading lists, to reflect the best recent research, and important work by members of under-represented groups. Please email your suggestions to phillib@hermes.cam.ac.uk including the relevant part and paper number. For information on how we handle your personal data when you submit a suggestion please see https://www.information-compliance.admin.cam.ac.uk/data-protection/general-data.