

Philosophy of Space and Time
HPS/PI 124
Spring 2008

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Office Hours: By appointment, or call first and stop by
Course website: <https://courses.hss.caltech.edu/Winter2010/hps-p1124>
Course Listserv:

Description: This course will examine philosophical issues involving space and time, and their 20th Century offspring, spacetime. We will look at these fundamental concepts both from a historical and from a philosophical point of view. In everyday life, we are all intimately acquainted with space and time. We observe objects occupying different locations in the space around us. We experience the passage of time as we wait for the minute hand to finally mark the end of a dull class. And we move – we occupy different spatial positions at different times. But when we try to say more definitely what space and time are, we encounter a host of perplexities: Are space and time ‘things’ like stars and electrons? Are they illusions? Are they abstractions that we create to understand the physical world? We understand what it means to move about in space, but does *time* move? Can any sense be made of metaphors like 'the march of time'? Is it possible to travel in time? These are just some of the questions about space and time that have been plaguing philosophers for millennia. With the advent of Einstein’s special and general theories of relativity, many of these questions have been profoundly transformed. We will read what philosophers have had to say about these questions from every major period in the history of Western philosophy.

Pre-requisites: Students must have completed their Freshman Humanities requirement in order to enroll in this course.

Class Meetings: Tuesdays and Thursdays, 10:30 – 11:55 A.M, Treasure Room, Dabney Hall.

Books: There is one book for this course: *The Philosophy of Space and Time*, by Hans Reichenbach. While we will not be using this as a textbook, we will be reading enough from this work to make it worthwhile purchasing. It may be ordered through Caltech’s online bookstore (<http://bookstore.mbsdirect.net/caltech.htm>).

Evaluation: Grades for this course will be based upon class participation (15%), performance as a discussion leader (15%), and two papers (35% each). All aspects of evaluation come under the provenance of the university’s honor code. A student must receive a passing grade on each of these components in order to pass the course.

Class Participation: Philosophy is a communal enterprise: the ability to make valuable oral contributions to philosophical discussions can be as important as the ability to write well. Moreover, since the written assignments will force the students to think carefully about very specific topics, participation in class discussion is an important way for students to demonstrate a broader competence with the material than is possible in the papers alone. Evaluation will be based upon the quality, not the quantity, of comments made during class. Students are encouraged to continue class discussions after the class is over, either by meeting with me in person, or by continuing the discussion over e-mail. Students who for any reason have difficulty speaking up in class are especially encouraged to pursue these options. It should go without saying that *attendance* is an absolutely essential component of class participation. Any student who has more than two unexcused absences from class will be required to do make-up work for the classes missed.

Discussion Leaders: Starting with the third week of class (January 19) students in the course will take turns being discussion leaders for specific classes. Each student will be a discussion leader for two classes. The schedule will be assigned during the third class meeting, on Tuesday, January 12. Discussion leaders will not be required to present the material, but they will provide the agenda for the class. In particular, discussion leaders should make note of which parts of the reading material were particularly difficult or in need of further elaboration from the instructors (preferably after consulting with other members of the class). In addition, they should prepare a list of questions, criticisms, and comments in order to facilitate class discussion. These are to be distributed via the course listserv at least 24 hours before each class meeting. Discussion leaders are encouraged to look at further readings to prepare. Worksheets will be passed out in class to help discussion leaders prepare.

Papers: Students are required to write two papers of approximately 2000 to 2500 words (7 - 8 double-spaced, typed pages). The first paper is due in class on Thursday, February 11; the second is due at 5 P.M. on Wednesday, March 17. Suggestions for paper topics will be distributed via the class listserv or the course website.

Optional fun project: Two bonus points (out of 100) will be awarded to the creator of funniest philosophy action figure (as voted on by the class), based on the readings from this class. See <http://homepages.nyu.edu/~iav202/powers/powers.html> for examples.

Special Accommodations: If you have a disability or personal circumstance that will require special accommodation, please do not hesitate to contact the instructor.

Readings: All readings for the class are included in the book *The Philosophy of Space and Time*, or available online or on the course website. The following calendar shows when various readings will be covered in class. Readings should be completed *before* they are covered in class. If you encounter any problems with a reading assignment — e.g., if the instructions are unclear, or if the pdf has only the odd-numbered pages — please contact me immediately by phone or e-mail; do not wait until the next class meeting.

Course schedule

Date Topic Readings

1/5 *Introduction and Course Mechanics*

The Absolutist – Relationist Debate

1/7 *Historical Background*

Aristotle, excerpts from *Physics* (Book 4)

Descartes, excerpts from *The Principles of Philosophy* (Part 2, sec. 1-36)

1/12 *The Leibniz-Clarke Debate*

Newton, “Laws of Motion,” from *The Mathematical Principles of Natural Philosophy*

From the *Leibniz-Clarke Correspondence*: Leibniz’s Second Letter, §1;

Clarke’s Second Reply, §1; Leibniz’s Third Letter, §§ 1 – 8;

Clarke’s Third Reply, §§ 1 – 8; Leibniz’s Fourth Letter, §§ 1- 19;

Clarke’s Fourth Reply, §§ 1 – 19; Leibniz’s Fifth Letter, §§ 47 – 63.

1/14 *Newton’s Rotating Bucket*

Newton, “Scholium”, from *The Mathematical Principles of Natural Philosophy* (pp. 408-417).

Mach, *The Science of Mechanics*, Chapter II, §6, ## 1 – 9.

1/19 *Right and Left*

Kant, “On the First Ground of the Distinction of Regions in Space”

Hofer, “Kant’s Hands and Earman’s Pions”

The Nature and Reality of Motion

1/21 *Zeno’s Paradoxes*

Plato, excerpts from *Parmenides*

Aristotle and Simplicius on Zeno’s paradoxes

Russell, *The Problem of Infinity Considered Historically*

1/26 *Instantaneous Velocity*

Arntzenius, “Are There Really Instantaneous Velocities?”

Smith, “Are Instantaneous Velocities Real and Really Instantaneous?”

The Nature and Reality of Time

1/28 *Ancient Puzzles*

Aristotle, excerpts from *Physics*
Augustine, excerpts from *Confessions*

2/2 *The A-series and B-series*

McTaggart, "The Unreality of Time" (excerpts from *The Nature of Existence*)
Price, excerpts from *Time's Arrow and Archimedes' Point*

2/4 *The Passage of Time*

Maudlin, "On the Passing of Time" from *The Metaphysics within Physics*

2/9 *The Arrow of Time*

Price, *Time's Arrow and Archimedes' Point*, Chapter 2
L. Boltzmann, *Lectures on Gas Theory*, §§ 88 – 90

Relativity

2/11 *The Special Theory of Relativity*

Einstein, "On the Electrodynamics of Moving Bodies" Kinematic Part
Minkowski, "Space and Time"

2/16 *The Conventionality of Simultaneity*

Reichenbach, *The Philosophy of Space and Time*, §§19 – 23

2/18 No class

2/23 *The General Theory of Relativity*

Einstein, "The Foundations of General Relativity", part A
Reichenbach, *The Philosophy of Space and Time*, §§ 36 - 37

2/25 *Geometry*

Einstein, "Geometry and Experience"
Reichenbach, *The Philosophy of Space and Time*, §§ 1 - 8

3/2 *Holes*

Norton, The Hole Argument, <http://plato.stanford.edu/entries/spacetime-holearg/>

Time Travel

3/4 *Time Travel in Modern Physics*

Arntzenius and Maudlin, "Time Travel and Modern Physics"
<http://plato.stanford.edu/entries/time-travel-phys/>

3/9 *The Paradoxes of Time Travel*

Dummett, "Bringing About the Past" (from *Truth and Other Enigmas*)
Lewis, "The Paradoxes of Time Travel" (from *Philosophical Papers, Vol. II*)

Other Important Dates

1/12 Scheduling of discussion leader assignments

1/22 Last day to add class

2/11 First paper due

2/24 Last day to drop course or change grading option to P/F

3/17 Final paper due

Suggestions for Further Reading: Here are a number of suggestions for further reading, which may be particularly helpful in conjunction with paper assignments and discussion leader duties. All of the further readings are available on open reserve in Dabney library, on the internet, in the text, or on the course website.

The Absolute-Relationist Debate:

Earman, *World Enough and Space-Time*, Chapters 1, 4, 6, 7

Hofer and Huggett, "Absolute and Relational Theories of Space and Motion,"
<http://plato.stanford.edu/entries/spacetime-theories/>

Huggett, *Space from Zeno to Einstein*, Chapters 4 – 9, 11

Nerlich, "Hand, Knees, and Absolute Space"

Sklar, *Space, Time, and Spacetime*, Chapter III

The Nature and Reality of Motion:

Albert, *Time and Chance*, Chapter 1, especially §3
Grünbaum, *Modern Science and Zeno's Paradoxes*, Chapters II, and III
Huggett, *Space from Zeno to Einstein*, Chapter 3
Huggett, "Zeno's Paradoxes," <http://plato.stanford.edu/entries/paradox-zeno/>
Le Poidevin, *Travels in Four Dimensions*, Chapters 7 and 9
Salmon, *Zeno's Paradoxes*, Introduction

The Nature and Reality of Time:

Albert, *Time and Chance*, Chapters 1 - 5
Callender, "Thermodynamic Asymmetries in Time,"
<http://plato.stanford.edu/entries/time-thermo/>
Horwich, *Asymmetries in Time*, Chapters 2 to 4
Le Poidevin, "The Experience and Perception of Time,"
<http://plato.stanford.edu/entries/time-experience/>
Le Poidevin, *Travels in Four Dimensions*, Chapters 8 and 12
Markosian, "Time," <http://plato.stanford.edu/entries/time/>
Price, *Time's Arrow and Archimedes' Point*, Chapters 3, 4
Savitt, "Being and Becoming in Modern Physics,"
<http://plato.stanford.edu/contents.html#space-and-time-being-and-becoming-in-modern-physics-Savitt>
Sklar, *Space, Time, and Spacetime*, Chapter V
Smart, "The Tenseless Theory of Time"
Zimmerman, "The Privileged Present"

Relativity:

CPAE 2, editorial note: Einstein on the Theory of Relativity, pp. 253-274.
CPAE 3, editorial note: Einstein on Length Contraction in the Theory of Relativity, pp. 478-480.
Earman, *World Enough and Space-Time*, Chapters 5, 9
Einstein, Correspondence: (AE to Varicak, 11 April 1910, J. Petzold to AE, 26 July 1919, AE to J. Petzold, 23 August 1919)
Huggett, *Space from Zeno to Einstein*, Chapter 13
Janis, "The Conventionality of Simultaneity" <http://plato.stanford.edu/entries/spacetime-convensimul/>
Malament, "Causal Theories of Time and the Conventionality of Simultaneity"
Norton, John. "What was Einstein's 'Fateful Prejudice'?"
Poincaré, *Science and Hypothesis*, Chapter IV, pp. 51 – 71
Reichenbach, *The Philosophy of Space and Time*
Renn and Sauer, "Heuristics and Mathematical Representation in Einstein's Search for a Gravitational Field Equation"
Rynasiewicz, "The optics and electrodynamics of 'On the Electrodynamics of Moving Bodies'"

Sauer, "The Einstein-Varicak Correspondence on Relativistic Rigid Rotation."
Sklar, *Space, Time, and Spacetime*, Chapter II; III, E; IV

Time Travel:

Earman, "Recent Work on Time Travel"

Earman and Wüthrich, "Time Machines," <http://plato.stanford.edu/entries/time-machine/>

Faye, "Backward Causation," <http://plato.stanford.edu/entries/causation-backwards/>

Horwich, *Asymmetries in Time*, Chapters 6, 7

Le Poidevin, *Travels in Four Dimensions*, Chapter 10

Markosian, "Time," <http://plato.stanford.edu/entries/time/>, § 7

Price, *Time's Arrow and Archimedes' Point*, Chapter 9

Thorne, *Black Holes and Time Warps*, Chapter 14