

Introduction: time and space

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<http://philosophy.ucsd.edu/faculty/wuthrich/>

146 Philosophy of Physics
Class 1, 27 September 2007

Course website

`http://philosophy.ucsd.edu/
faculty/wuthrich/teaching.html`

There, you can find:

- syllabus (make sure you get an up-to-date copy)
- lecture notes
- handouts
- **midterm paper assignment**
- ...

You are responsible for reading your email.

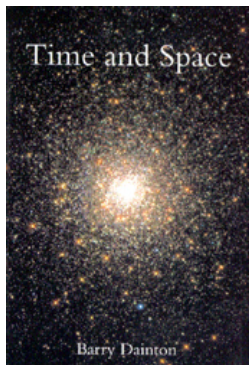
Contact me

Office hours: Mo 1-2, Th 2-3, and by appointment

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Required texts



Barry Dainton, *Time and Space*, McGill-Queen's University Press (Montreal and Kingston, 2001). This book is available at the Price Center Bookstore. (~\$23)

There are links from the course web page to all other articles, except those that will be made available through e-reserves.

Course requirements and evaluation

- 1 *Quizzes* (30 points)
- 2 *Midterm paper* (30 points)
- 3 *Final exam* (40 points)

Item 2 (midterm paper) must be submitted *both as hard copy as well as through* `turnitin.com` in order to earn credit.

Enroll in this class at `turnitin.com` by creating a new profile.
You will need the following information:

Class ID = 1931313

Enrollment Password = 599681

Please contact me or the UCSD Student Conduct Coordinator or his Assistant at 4-0778 if you have trouble creating or accessing an account. **Troubles like these will not be an acceptable reason for late assignments.**

(1) Quizzes (30 points)

- six short quizzes, each worth five points
- will be announced in class one meeting before they will be held
- no make-up quizzes will be given

(2) Midterm paper (30 points) [turnitin.com]

- **take-home midterm paper** worth 30 points, due on 6 November 2007 at the beginning of class
- must be submitted both in hard copy and through `turnitin.com`
- “open books”: use all sources, but they must be acknowledged and properly referenced
- in all cases, use your own wording
- late penalty (hard copy or `turnitin.com`): 5 points/day

(3) Final exam (40 points)

- **final exam** on 14 December 2007, 11:30am-2:29pm, location TBA
- short identifications, one-paragraph-answer questions, and question asking for an essay-length answer
- “closed books”
- cumulative

Additional rules

- You must observe the University's Policy on Integrity of Scholarship, which can be found at <http://www-senate.ucsd.edu/manual/appendices/app2.htm>.
- Make-up exams (for both midterm and final) will only be given under the most severe circumstances. The student who wishes to write a make-up exam must inform me (by phone or email) ahead of the time of when the exam is due (midterm) or takes place (final). In order to qualify for a make-up exam, appropriate evidence of the most severe circumstances must be produced by the student. I will determine, in consultation with the student, what qualifies as appropriate evidence.

Introduction to the course: time and space

- Does time pass? If so, what does this mean? If not, why does it feel that way?
- Is only the present real? Or are past or future real as well?
- Is space in itself real, or is it simply nothingness?
- Are space and time finite or infinite? Do they have beginning and end?
- How many dimensions does space have? And time?
- simple questions about most fundamental aspects of our world, relevant to anyone who seeks understanding of cosmos, yet very hard to answer!

St Augustin (354-430), Bishop of Hippo



“What, then, is time? If no one asks me, I know what it is. If I wish to explain it to him who asks me, I do not know. Yet I say with confidence that I know that if nothing passed away, there would be no past time; and if nothing were still coming, there would be no future time; and if there were nothing at all, there would be no present time.”
(*Confessions*, 11.xiv.17)

- vast literature in philosophy, physics, mathematics: many answers to these questions have been proposed, some not obvious at all
- many exciting und exotic ideas, many require serious training to be appreciated
- goal of this course: to facilitate this appreciation
- presuppose no prior exposure to subject or to relevant physical theories
- philosophical jargon and physical concepts and theories will be explained as we go along, to the extent we need it

Organization of course (and textbook)

1 Chs. 2-8: Time

- McTaggart's argument against the reality of time
- static conceptions of time: no passage
- surviving dynamic conceptions of time ("growing universe", "presentism")
- phenomenology of time
- time travel

2 Chs. 9-15: Space

- Leibniz-Newton debate: relationism vs. substantivalism
- modern reincarnations of this debate
- non-Euclidean geometries
- Kant and parity
- Poincaré's conventionalism
- Foster's spatial antirealism

3 Chs. 16-20: Spacetime

- Einstein's special theory of relativity and its implications for time
- Minkowski's spacetime
- Einstein's general theory of relativity and its implications for space(time)
- String theory and loop quantum gravity

Do space and time exist?

- Do space and time have independent existence from objects they “contain”?
- inaccessible by direct observation
- this in itself doesn't imply that they don't exist: neutrinos and force fields are not directly observable either, but many believe they exist
- **Substantivalism vs relationism**

Position (Substantivalism)

Space and time exist as independent substances, i.e. they are existing particulars in their own right, over and above the material content of the universe. Space and time are continuous and pervasive media that extend everywhere and everywhen.

Position (Relationism)

Space and time do not exist as independent substances, there is only the material content of the universe. Space and time are merely defined through spatiotemporal relations among the material objects in the universe.

Nota bene: relationists admit that there are spatiotemporal relations among bodies, but they deny that this implies the existence of space and time.

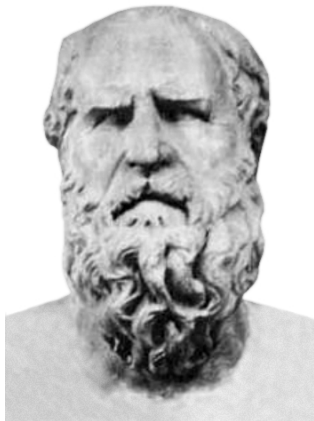
What is the structure of space and time?

- Is space finite or infinite in extension? How many dimensions does it have? Is it Euclidean? Isotropic? Continuous or discrete?
- Is time finite or infinite? Does it have a beginning or an end? Is it one-dimensional? Linear or branching? Anisotropic, i.e. directed? Continuous or discrete?
- Are there different kinds of spaces or times?
- Are space and time affected by the presence and distribution of material bodies?

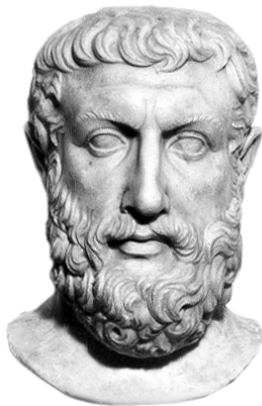
Why does time, but not space, have a direction?

- Time seems to have inherent directedness from the past towards the future, but space has no analogous feature
- directedness *of* time vs. directedness of anything *in* time
- “flow” of time, “passing” of time
- temporal passage: “What is future will become present; what is present will become past; what is past was once present.” (Dainton 7)
- Is temporal passage objective feature of reality?

Heraclitus vs. Parmenides



Heraclitus of Ephesus
(~ 540-480 BCE)



Parmenides of Elea
(~ 510-450 BCE)

Position (Dynamic view of time)

Temporal passage is objective feature of reality, which is independent of perspective that conscious beings may take. On this view, passage can be understood differently: either there's a "moving present", succession of ephemeral presents; or there's irreducible "becoming" which turns future, as of yet non-existing events into the present (and thus into existence), from which they recede into ever more distant past.

Position (Static view of time)

There's no temporal passage qua objective feature of world. There's no moving or changing present; all events are equally real; difference bw past, present, and future merely matter of perspective. Time and space are ontologically equivalent in a crucial way: space = 3dim arrangement of coexisting locations (places), time = linear 1dim series of coexisting locations (times), and none of these locations is privileged.

A-series and B-series (McTaggart)

∃ two distinct ways in which events can be ordered in time:

Characterization (A-series)

Events can be ordered by their relation to the “now”, i.e. how much they are “past” or “future” etc. Events have temporal properties such as “three days ago”, “present”, “far in the future” etc. The order runs from the remote past through the recent past, the present, into the near future and finally into the far future. Pastness, presentness, futurity are basic A-properties. A-facts are transitory and A-sentences change truth values over time. The A-series is a dynamic temporal ordering.

Position (Tensed theory)

A-concepts such as past, present, future have “essential and ineliminable role to play in any metaphysically adequate account of the nature of time.” (11)

Characterization (B-series)

Events can be ordered by binary, asymmetric, irreflexive, transitive relation of precedence. Thus, we have B-properties such as “simultaneous with”, “earlier than”, “later than”. B-facts are eternal and B-statements are timelessly true or false. The B-series is a static temporal ordering.

Position (Tenseless theory)

B-concepts such as earlier than etc “are all we need for a metaphysically adequate account of time.” (12)

Nota bene: static vs. dynamic dispute is about nature of time, but tensed vs. tenseless dispute is over concepts needed for metaphysically adequate account.

Physics and metaphysics

- Are these questions necessary and *a priori*, or contingent and *a posteriori*?
- If the latter, does philosophy of space and time collapse to physics?
- **Platonic vs. Euclidean method**
- science matters, but not *only* science: metaphysical prejudices of scientists, interpretation of mathematical apparatus of thy, distinctive metaphysical domains and methods of enquiry
- laws of nature are *contingent* \Rightarrow space and time could have been different \Rightarrow conceptual interest in what time and space are independently of particular sci thys