Space: Conceptions of Void

Christian Wüthrich

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

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Substantivalism vs. Relationalism

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.
An intuitive model of space: the void conception

“Space itself is nothing at all; it has no intrinsic features of its own, it is mere absence. Objects can be separated by different spatial distances... and we know this because of the different times it takes to travel or transmit signals between them; we cannot directly measure magnitudes of space, since space is itself featureless void.” (Dainton, 132)

Consequences:

1. space must be infinite
2. there’s only one space
3. question “What structure does space have?” is empty
The plenum universe

The Christian Aristotelian cosmos, engraving from Peter Apian's Cosmographia, 1524

- “Naturam a vacuo abhorrere” (There can be no vacuum in Nature), idea originating in Aristotle
- Aristotle: sub- and supralunar spheres, space does not continue beyond outermost sphere
- Descartes: interplanetary space filled with subtle fluid
Sir Isaac Newton (1643-1727)

- English physicist, mathematician, astronomer, natural philosopher, theologian, and **alchemist**
- education at Trinity College, Cambridge
- Lucasian Professor of Mathematics in 1669 at Cambridge
- *Principia Mathematica* (published in 1687)
- synthesis of mechanical results by Galileo, Kepler, etc
“Space is eternal in duration and immutable in nature... Although space may be empty of body, nevertheless it is itself not a void: and something is there, because spaces are there, although nothing more than that.” (De Gravitatione, as quoted by Dainton, 133)

“Absolute space, in its own nature, without relation to anything external, remains always similar and immovable.” (Principia, as quoted by Huggett, 118)
Historical aside: Giordano Bruno (1548-1600)

- Italian philosopher, magician, theologian, cosmologist, and occultist
- “There is a single general space, a single vast immensity which we may freely call VOID; in it are innumerable globes like this one on which we live and grow. This space we declare to be infinite, since neither reason, convenience, possibility, sense-perception nor nature assign to it a limit... It diffuseth throughout all, penetrateth all and it envelopeth, toucheth and is closely attached to all, leaving nowhere any vacant space.” (On the Infinite Universe and Worlds, as quoted by Dainton, 339)
Two objections against void conceptions

1. Flatland
2. Pleasantville and Harshland Thought Experiment
(1) Flatland

We might find ourselves in the very same predicament as the flatlanders!

Figure 9.1 Two conceptions of Flatland. The Flatlanders on the left are free to rove where they like on their plane. The Flatlanders on the right also inhabit a plane, but are further confined to moving back and forth along their world’s surface (the thick line). Consequently, these Flatlander’s would have to climb over the tree to get past it (likewise for each other). Note also the way their internal organs are clearly visible from the vantage point of the third dimension.
Question: Could there be an additional spatial dimension, i.e. could there be a “hyper-up” and a “hyper-down” direction?

- probably not, as we don’t encounter object spontaneously appearing as if from or disappearing as if to nowhere
- at least we have a constraint of how objects can move in hyper-direction
- but if space is simply nothing, it’s not at all clear why there should be such a restriction

⇒ confinement to three dims doesn’t sit well with void conception, unless there are independent reasons to assume that space is three-dimensional
Problem: if space is mere absence, the very possibility of spatial connection becomes problematic

Thought Experiment (Pleasantville and Harshland)

Inhabitants of “Pleasantville” discover that eating certain root causes them to vanish, only to reappear some time later. Repatriates also bring back tales from another planet “Harshland”, which show high intersubjective agreement.

- Question: how can this be accounted for?
- E.g. Pleasantville and Harshland each exists within a separate space

⇒ possibility of multiple unconnected, distinct, separate spaces—pace the void conception
- our experience could be such as to warrant the postulation of two distinct spaces
Furthermore, void conception fails to deliver explanation of distinctive ways in which things are connected in space. If there is no such connection, i.e. if there is absolutely nothing bw spatially distant material objects as objects are separated by “expanse of void”, they don’t stand in a spatial relation, they can’t collide or interact, etc.

⇒ two types of explanations required: for constraints on spatially related objects, and connections bw them
Substantivalism: a closer look

- “Fluid World”: infinite and infinitely divisible three-dimensional, undetectable Fluid that permeates everything
- this Fluid is space
- solves problem of constraints: objects are confined to move in three dims bc Fluid itself is three-dimensional
- solves problem of connection: objects are connected by expanses of Fluid

⇒ Space is substantival, endowed with intrinsic nature of some kind
⇒ But why is it completely bereft of detectable properties then?
The locating of objects in substantival space

By virtue of what is an object located in space that contains it?

1. **Relational substantivalism**: primitive relation of “spatial locatedness” holds bw objects and places in space

2. **Container substantivalism**: material objects enclosed by substantival space, but space only outside and bw material things

3. **Super-substantivalism**: space is *only* existing entity, objects are “adjectival” on space

Note: space possesses certain topological and geometrical properties, such as conforming to axioms of Euclidean geometry
undetectability, Occam’s razor ⇒ let’s investigate whether we can do without substantival space

Position (Relationism)

“In claiming that objects inherit their spatial properties from the regions of space that they occupy, the substantivalist is inserting an invisible and redundant intermediary between objects. We cannot observe space itself, but we can observe objects at various distances from one another. The most economical way of making sense of this is simply to say that objects are directly related to one another by spatial relations. Instead of appealing to space-object relations, we can appeal to object-object relations, where the relations in question are of a spatial sort. These spatial relations should not be thought of as material objects in their own right, but as distinctive properties, of a relational sort, that material objects can possess.” (Dainton, 141)
space is constituted by complex relational structure of material objects and their parts and the spatial relations in which all these stand to one another

- concrete, symmetrical, transitive, reflexive relation
- relationism not cost-free: there must be spatial relations over and above the material objects that exist
- empty space: relationism is committed to non-existence of unoccupied places and regions, whereas substantivalist account entails possibility of empty places

⇒ How can we meaningfully speak of mid-point between Earth and Mars?
• Relationist response: since objects can change in their spatial relations, we can give map/representation that reflects these possibilities.

• at any given time, only objects and their actual distance relations exist, all remaining points on map do not correspond to anything real.

• relationists: truthmakers of statements about space are facts about material bodies and the way they are spatially related.

• relations operate across, rather than through space.

• they relate objects directly, without passing through intervening empty space (whose reality is denied).
Question: What is the distance bw P and Q in each case?

Figure 9.2 Spatial surgery. Deleting points leaves holes in space – but is the distance between P and Q altered as a result? The answer depends on the conception of distance we adopt.
Gaussian conception: distance as “shortest path length”, where path is continuous route through points in a space, i.e. paths are themselves part of space

⇒ in B, points are more than 20m apart, in C they no longer stand in any distance relation

• this conception is basis of differential geometry

Intrinsic conception: distance bw points depends upon nothing but points themselves and they are directly related to one another, i.e. embedding is irrelevant

⇒ points are at distance of 20m in all three cases

• mathematically embodied in abstract structure of metric space

What are the ramifications of both conceptions for substantivalism-relationism debate? (Cf. Dainton 147f)
Two concepts of motion

Since both positions seem to be internally coherent, we may want to look at empirical and scientific results to inform the debate.

- big issue: dynamics of moving bodies
- substantivalist: body moves if it occupies different locations in substantival space at different times
- relationist: body moves if its distance relations with other material bodies changes over time
- motion wrt substantival space is called **absolute**

⇒ some motions are **absolute** for substantivalist, but not for relationist, for whom all motion is relative to other material bodies

- Example of rocket ships at relative motion