

## Endurantist and Perdurantist Accounts of Persistence

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### Outline

- I. Three Issues from the Endurantist/  
Perdurantist Debate
- II. Dimension and Location in Spacetime
- III. Atemporal Parthood and Temporal Parts
- IV. Endurantist and Perdurantist Accounts of  
Persistence
- V. Concluding Remarks

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### I. Three Issues in the Endurantist/ Perdurantist Debate

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### The Issues:

(DIM) Whether objects are three-dimensional or four-dimensional.

(TP) Whether objects have or lack proper temporal parts.

(PART) Whether objects stand only in time-relative parthood relations.

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### Perdurantists and Endurantists

- Typically, perdurantists hold that persisting objects i) are four-dimensional (extending in three spatial and one temporal dimension); ii) have a temporal part for each moment through which they persist; and iii) stand in atemporal parthood relations.
- Typically, endurantists hold that persisting objects i) are at most three-dimensional (extending only in spatial dimensions); ii) lack temporal parts; and iii) have parts only relative to a time.

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### Temporal Parts

- David Lewis: "something *perdures* iff it persists by having different temporal parts...at different times, though no one part of it is wholly present at any one time; whereas it *endures* iff it persists by being wholly present at more than one time." (1986, *On the Plurality of Worlds*, p. 202)
- McCall/Lowe: "something...*perdures* if it persists by having different temporal parts at different times, though no one part of it is wholly present at any one time...An object *endures* iff i) it lacks temporal parts, and ii) it exists at more than one time" (2009, "The Definition of Endurance")
- Ted Sider: "four-dimensionalism may...be formulated as the claim that, necessarily, each spatiotemporal object has a temporal part at every moment at which it exists" (2001, *4Dism*, p. 59).

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### Dimension

van Inwagen: "It is sometimes said that there are two theories of identity across time. First, there is 'three-dimensionalism', according to which persisting objects are extended in the three spatial dimensions and have no other kind of extent and persist by 'enduring through time' (whatever exactly that means). Secondly, there is 'four-dimensionalism' according to which persisting objects are extended not only in the three spatial dimensions but also in a fourth, temporal, dimension, and persist simply by being temporally extended" (1990, "Four-Dimensional Objects")

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### Parthood

Katherine Hawley: "I propose to characterize endurance as follows: an object endures if and only if (i) it exists at more than one moment and (ii) statements about what parts the object has must be made relative to some time or other." (2001, *How Things Persist*, p. 27)

(Hawley characterizes perdurance theory as the view "according to which objects persist through time by having temporal parts" p. 10)

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### The parthood assumption

- (Sider, 2001) offers no positive characterization of three-dimensionalism. He assumes that three-dimensionalists must reject the four-dimensionalists' notion of atemporal parthood (p.57), but he thinks that three-dimensionalism is consistent with the thesis that objects have some (perhaps even many instantaneous) proper temporal parts (p. 64-65).
- In his Vagueness Argument for four-dimensionalism, Sider uses time-relative mereological relations to argue that each object has a temporal part at every moment at which it exists.

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### The parthood assumption

Eric Olson rejects Sider's 3D-friendly definition of temporal parts in terms of time-relative parthood. Like Sider, Olson assumes that three-dimensionalists must reject atemporal parthood. Olson argues that, to preserve the distinction between three-dimensionalist and four-dimensionalist accounts of persistence, we need an account of temporal parthood in terms of atemporal parthood. (2006, "Temporal Parts and Timeless Parthood")

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### The parthood assumption

Trenton Merricks uses the assumption that, given both eternalism and endurantism, parthood must be a ternary time-relative relation to argue that eternalism and endurantism are inconsistent. (1999, "Persistence, Parts, and Presentism").

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### The purpose of my paper:

To argue that:

- One standard endurantist position on (DIM) is compatible with standard perdurantist positions on (TP) and (PART)—in particular, that the sort of atemporal parthood relation favored by most perdurantists can be combined with an endurantist position on dimension.
- Given eternalism, endurantist and perdurantist *accounts of persistence* hinge on issue (DIM), not on the auxiliary assumptions about parthood and temporal parts.

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### Assumptions for the remainder of this paper

- Eternalism—all times and the objects present at those times are equally real.
- All objects are located in spacetime.
- Galilean spacetime—spacetime is partitioned by an absolute simultaneity relation on spacetime points. (I will treat time-slices—maximal sets of absolutely simultaneous spacetime points—as the absolute times.  $T$  is the set of all times and the variable  $t$  ranges only over times.)

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### II. Dimension and Location in Spacetime

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### Endurantist and Perdurantist Positions on Dimension

- (3D) Each persisting object  $x$  exactly occupies multiple three-dimensional regions  $r_{xt}$  where: i) each  $r_{xt}$  is included in some time and ii) for each time  $t_0$  through which  $x$  persists, exactly one of  $r_{xt}$  is included in  $t_0$ . If there are any non-persisting objects, each of these objects exactly occupies just one region and this region lies within a single time-slice.
- (4D) Each persisting object  $x$  exactly occupies a unique four-dimensional region  $r_x$  which spans  $x$ 's entire life (in particular,  $r_x$  crosses each time through which  $x$  persists). If there are any non-persisting objects, each of these objects exactly occupies a unique region lying within a single time-slice.

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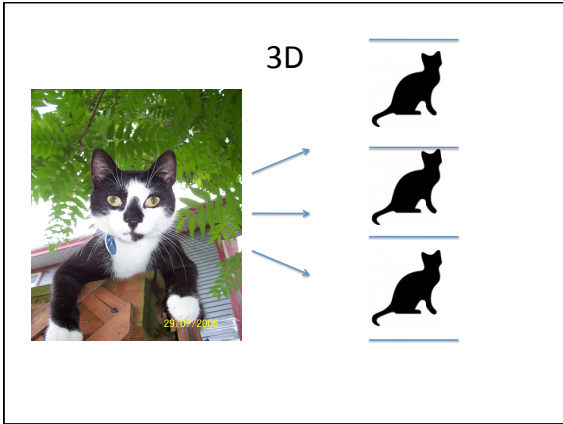
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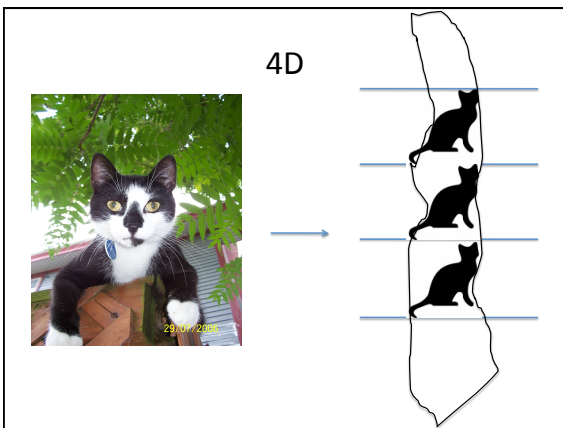
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### Spacetime Paths

For any object  $x$ ,  $x$ 's spacetime path is the union of  $x$ 's locations in spacetime:

$Path(x) =_{\text{def}} \cup \{r : r \text{ is a spatio-temporal region and } x \text{ exactly occupies } r\}$

- Given (4D), an object's path is identical to its unique spacetime location.
- Given (3D), no persisting object's path is identical to any of its 3D locations.
- On either (3D) or (4D), each object has a unique spacetime path. Though proponents of (3D) and (4D) disagree about which regions objects exactly occupy, they agree about which regions are objects' paths.

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**Other Relations between Objects (and Times)**

$x$  is present at  $t =_{\text{def}} \text{Path}(x) \cap t \neq \emptyset$

( $x$  is *present* at time  $t$  iff  $x$ 's path crosses  $t$ )

Note: Persisting objects are objects that are present at more than one time.

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**Other relations between objects (and times)**

object  $x$  is path included in object  $y =_{\text{def}} \text{Path}(x) \subseteq \text{Path}(y)$ .  
 (object  $x$  is *path included* in object  $y$  iff  $x$ 's path is included in  $y$ 's path)

object  $x$  is a temporal segment of object  $y =_{\text{def}}$   
 $\forall t \in \mathbf{T}$  (if  $x$  is present at  $t$ ,  
 then  $\text{Path}(x) \cap t = \text{Path}(y) \cap t$ ).

(object  $x$  is a *temporal segment* of object  $y$  iff  $x$ 's spatial extent matches  $y$ 's spatial extent within every timeslice at which  $x$  is present)

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**Other relations between objects (and times)**

Object  $x$  is temporarily included in object  $y$  at time  $t =_{\text{def}} \text{Path}(x) \cap t \subseteq \text{Path}(y) \cap t$ .

(object  $x$  is *temporarily included* in object  $y$  at time  $t$  iff the segment of  $x$ 's path that lies within  $t$  is included in the segment of  $y$ 's path that lies within  $t$ )

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III. Atemporal Parthood and Temporal Parts

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**Atemporal Parthood for Endurantists**

Though it is usually assumed that endurantists are stuck with only time-relative parthood, there are exceptions:

- Kit Fine thinks that two distinct parthood relations—timeless parthood and temporary parthood—hold between objects (1999, "Things and their parts"). But Fine's timeless parthood relation only applies to certain kinds of objects ('rigid embodiments') and the timeless parts of these objects are required to stay with them throughout their lives.
- Thomas Sattig leaves open the possibility that, given (3D), an atemporal parthood relation may hold among objects. But he assumes that, given (3D), no persisting object can have a part that occupies a unique spatiotemoral region (2006, *The Language and Reality of Time*, p. 55).

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**Path Inclusion as Parthood**

- Unlike Fine's timeless parthood relation, path inclusion roughly matches the atemporal parthood relation adopted by most perdurantists. This sort of parthood relation allows persisting objects to have proper temporal segments as parts.
- Under both (3D) and (4D), path inclusion is a well-defined atemporal relation.

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Possible objections to counting path inclusion as parthood are the same for proponents of (3D) and (4D):

- path inclusion does not preserve ordinary intuitions about which parts objects have;
- without extra assumptions about how objects are located in spacetime, path inclusion has only weak logical properties;
- perhaps facts about parthood are not reducible to facts about location in spacetime.

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### Temporal Parthood

- Assuming that the proponent of (3D) can adopt something like path inclusion as her parthood relation, she might define temporal parts in terms of location--as does, e.g., Heller in (1984, "Temporal Parts of Four Dimensional Objects") --so that temporal parts turn out to be temporal segments.
- (3D) is consistent with objects having indefinitely many, arbitrarily small temporal segments as long as we allow that distinct objects may share a spatiotemporal location.

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### Dimension, Temporal Parts, and Parthood

- (3D) is consistent with a standard perdurantist position on temporal parts and atemporal parthood as long as i) it is possible for distinct objects to share a location (though not necessarily a path) and ii) proponents of (3D) are allowed the same degree of divergence from ordinary intuition in their parthood relations as are standard perdurantists.
- (4D) is at least consistent with a standard endurantist position on parthood.

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#### IV. Endurantist and Perdurantist Accounts of Persistence

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#### Distinct accounts of persistence in (3D) and (4D)

- According to (3D), an object persists by occupying multiple regions each of which lie within different timeslices. (An object persists by being *wholly present* at different times.)
- According to (4D), an object persists by occupying a single region which passes through different timeslices. (An object persists by extending through different times with out being wholly present at any time.)

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#### Positions on temporal segments and parthood are not accounts of persistence

- A position on how many temporal segments objects have is a position on what objects there are--specifically, on how many short-lived objects there are along the paths of longer-lived objects--not on how these objects persist. (This point is made in, e.g., Olson, 2006, "Temporal Parts and Timeless Parthood".)
- A position on whether a relation like path inclusion is an acceptable parthood relation has to do with the strength of our commitments to ordinary intuitions about parthood (or to classical mereological principles) which are independent of an account of persistence.

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### Endurantist and Perdurantist Accounts of Persistence

- The intermediate position that combines (3D) with perdurantist positions on temporal parts and parthood adopts a standard endurantist account of persistence.
- The intermediate position that combines (4D) with endurantist positions on temporal parts and parthood adopts a standard perdurantist account of persistence.

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### V. Concluding Remarks

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- If I am right about the consistency of (3D) with perdurantist positions on temporal parts and parthood, we might take this to show that there is not a huge difference between (3D) and (4D) (and so between endurantist and perdurantist accounts of persistence, given appropriate assumptions about spacetime).
- Alternatively, we might wonder whether (3D)'s distinction between an object's path and its locations makes sense. I think that (3D) becomes problematic if we try to transfer it to a relativistic setting. As far as I know, no endurantist has offered an account of location that applies across the spacetimes of general relativity. (Gilmore, 2006, "Where in the Relativistic World are We?" ) and (Gibson and Pooley, 2006, "Relativistic Persistence") raise problems with some simple attempts at transferring (3D) to special relativistic spacetimes.

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