Mereological Endurantism Defined

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Abstract. I develop a definition of mereological endurantism which overcomes objections that have been proposed in the literature and thereby avoids the charge of obscurity put forward by Sider against the view.

What is endurantism? According to a standard definition, it is the view that

(3D)   material objects persist through time by being *wholly present* at each instant at which they exist.

But this definition takes the question only one step forwards. For what is it for something to be wholly present at a time? In his *Four-Dimensionalism*, Ted Sider has argued that the phrase resists precise definition and that it is therefore 'far from clear that three-dimensionalism can be adequately formulated' (2001, 63). Despite some attempts to solve this problem – such as those to be found in Gilmore (2006), Merricks (1999), Parsons (2007), and Sattig (2006), the problem still remains (or so I will argue).

The aim of this paper is to put forward a simple and effective definition of 'wholly present', show that the new definition is immune to Sider's criticisms and argue that it is better than alternative definitions to be found in the literature. Unlike Gilmore's (2006) and Sattig's (2006), it is a definition pertaining to what is nowadays sometimes called *mereological* endurantism, instead of its locative counterpart. Unlike Merricks' (1999), the definition carries no commitment to presentism. Unlike Parsons' (2007), it does not require, among other things, persisting objects to be extended simples.

§ 1   Sider on 'wholly present'

What is it, then, for x to be wholly present at time t? Here are several options considered by Sider. First, there is the idea that:

(S1) x is wholly present at time t iff every part of x exists at t.

However, when we say, 'every part of x', what do we mean precisely? We might mean 'every part that x has at t' or 'every part that x has at *any* time':

(S2) x is wholly present at time t iff every part of x at t exists at t

(S3) x is wholly present at time t iff every part of x at any time exists at t

In passing from (S1) to (S2) or (S3), Sider has passed from using the timeless notion of parthood – x is part of y – to using the temporary notion of parthood – x is part of y at t. Sider intends to use temporary parthood as a friendly gesture towards his opponent three-

dimensionalists, who often like their attributes – properties or relations – to be had relative to times, rather than *simpliciter*[1].

However, neither (S2) nor (S3) seem to yield plausible definitions of three-dimensionalism. (S2) is too weak to distinguish three-dimensionalism from four-dimensionalism. Indeed, also the four-dimensionalist would accept that everything that is part of a material object at t exists at t. How could something be a part of x at a time without existing at that time?

On the other hand (S3) is too strong. The resulting definition of three-dimensionalism would require parts of a material object to exist at all times at which the material object itself exists. For example, the current left headlamp of my car would need to exist at all times at which my car exists, if my car is to be wholly present at each instant of the car's persistence. Despite my desire to change the headlamps of my car as little as possible, I do not take to be part of the three-dimensionalist doctrine that the *current* headlamps of my car – as well as any other of its parts – need to exist in order for my car to be wholly present. As a three-dimensionalist, I take my car to be able to be wholly present also at times at which my current headlamps have been replaced and eventually destroyed. Material objects change their parts and, once changed, the original parts might stop existing without the object itself ceasing to be wholly present.

Sider takes also into account a related definition of wholly present according to which something is wholly present at an interval T iff everything that is at any time in T part of x (i) exists at every time in T and (ii) *is part of x at every time in T* (Sider 2001, 64). The alternative definition considered by Sider is slightly easier to refute than the preceding one[2]: the resulting

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[1] Presentists might be an exception here. More on this later.

[2] On closer look, a part of it is also redundant. Given what we have said before, insofar as nothing can be part of something at a time without existing at that time, (ii) implies (i).

definition of three-dimensionalism makes it impossible for three-dimensional objects to gain

or lose parts (no matter whether such parts continue to exist or not)[3].

Finally, Sider considers the option that three-dimensionalism might be the simple claim that

material objects do not have proper temporal parts (Sider 2001, 64). Here, Sider's point is

that, surprisingly, three-dimensionalists too believe in some cases in proper temporal parts.

Consider the case of a statue and a lump of clay which exist at one instant t only. If the lump

of clay is considered to be a proper part of the statue, then it will turn out to be a proper

temporal part of the statue as well, for (i) it is a part of the statue at t, (ii) it exists only at instant

t and (iii) it overlaps anything that is part of the statue at t, thus satisfying all three conditions

indicated in Sider's definition of a temporal part. Of course, one might take this to be a

shortcoming of Sider's definition of a temporal part. However, it is not easy to see how else

temporal parts could be defined, and certainly all definitions on the market predict the same

consequence.

Having reviewed all definitions that he takes to have any plausibility, Sider concludes that is

'far from clear that three-dimensionalism can be adequately formulated' (Sider 2001, 63) and

it therefore remains an obscure doctrine.

§ 2   Wholly present defined

Plausibly enough, *whole* presence contrasts with *partial* presence. Partial and whole presence

seem to have to do with the way in which something is present at a time. Now, something

might be present at a time by having some part at that time. This is for example the way in

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[3] Sider considers a modal variant of this definition, which has the drawback of placing the dispute between
three- and four-dimensionalism in the realm of modality. The dispute is about 'what objects actually do, not
what they are capable of doing' (Sider 2001, 67). The conception of whole presence that I put forward in the
next section is not modal in nature.

which a football match is present at the first half of the period of its occurrence, namely by having a part – its first half – at that time. And this is what we call partial presence. On the other hand, something might be present at a time by being a whole at that time. This is the way in which a three-dimensionalist takes his objects to be present at different times: the car is present as a whole at each instant of its persistence, and not only by having some part at that time.

(IGP)   Something is partially present at a time iff it is present at that time by having some part at that time.

(IGW)   Something is wholly present at a time iff it is present at that time by being a whole at that time.

But how can we turn such intuitive glosses into accurate definitions? Here is a simple way of doing this. Let us consider all parts of an entity x at a time. Let us fuse them together and get their mereological sum – the mereological sum s of all parts of x at that time. Now consider the question: is s a proper part of x? If x is like a football match, then yes: s will be a proper part – in fact a proper temporal part – of x. On the other hand, if x is like my car, then no: s will not be a proper part of x, for s will be nothing else than x itself. Indeed, if you consider all current parts of my car and fuse them together, what you will get is the car itself, and not a proper part of it. In other words,

(IGW') x is wholly present at a time t iff x is identical with the sum of its proper parts at t.

Let us proceed more cautiously. We shall write

$x\mathrm{E}t$	for	'x exists at t'
$x <_{\mathrm{t}} y$	for	'x is part at t of y'[4]
$x <<_{\mathrm{t}} y$	for	'x is proper part at t of y'
$x \circ_t y$	for	'x overlaps at t y'
$\sigma_{\mathrm{t}} x\, \varphi x$	for	'the sum at t of the of every x such that φx'

We shall define such predicates as follows:

$$x <<_{\mathrm{t}} y \quad := x <_{\mathrm{t}} y \wedge x \neq y$$

$$x \circ_t y \quad := \exists z\, (z <_{\mathrm{t}} x \wedge z <_{\mathrm{t}} y)$$

$$\sigma_t x\, \varphi x \quad := \iota z\, \forall y\, (y \circ_t z \leftrightarrow \exists x\, (\varphi x \wedge y \circ_t x))$$

We are now in a position to define whole presence. Once again, something is wholly present at a time t iff it is identical with the sum of its parts at t.

Whole presence 1

x is wholly present at time $t := \sigma_t y\, [y{:}\, y <<_{\mathrm{t}} x] = x$

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[4] I am here assuming a notion of temporary parthood whereby a temporary part is such that it is entirely located at the relevant time – $x <_{\mathrm{t}} y \to x@_{<}t$ – where an entire location of x is conceived of as a region which has an exact location of x as a part – $x@_{<}r := \exists s\, (x@s \wedge s < r$ (Casati and Varzi 1999). To illustrate, under such an understanding, a perdurantist would say that the current temporal part of my left hand is a part now of me, whereas my left hand as a perduring entity is not a part *now* of me, for it is not entirely located at the present instant (but of course it is a part of me at the interval of my persistence, or at a time which is an entire location of my left hand). If this is not a reader's notion of temporary parthood, she can add a clause to the effect that the proper temporary parts under consideration must also be entirely located at the relevant time.

We have defined whole presence by considering the proper parts of an entity at a time, instead of its parts (proper or improper) at that time. Why? Because if we had considered the proper or improper parts of the entity at that time, also the entity itself, as an improper part of itself, would be included. Hence, also the four-dimensionalist would have agreed that material objects are wholly present at each instant of their persistence. However, in taking care of this problem, it seems that we have not considered an important case. What if the persisting object we are considering does not have proper parts at that time? This would not be a problem for those three-dimensionalists who are friends of gunk. But not all three-dimensionalists are. Hence, in order to take care of this case, let us introduce the condition that x must be mereologically complex.

$C_t x$ for 'x is mereologically complex at t'

$C_t x$:= $\exists y \, (y <<_t x)$

In turn, whole presence can be conceived of along the following lines:

(IGW'') x is wholly present at a time t iff: x exists at t and if x is complex at t, then x is identical with the sum of its proper parts at t.

The first condition is required, for something might fail to be complex at t simply because it fails to exist at that time. And we certainly do not want something that does not exist at a time to be wholly present at that time. Accordingly:

Whole presence 2

x is wholly present at time *t* := $xEt \wedge C_t x \rightarrow \sigma_t y\ [y: y <<_t x] = x$

If the antecedent of the implication is false, the object will turn out to be wholly present at each time at which it exists. And rightly so: a four-dimensionalist would never accept that a persisting object can be mereologically simple, for if it persists it must be composed by at least some proper temporal parts[5].

So far, in defining whole presence, we have used a functional notion of mereological sum, hence assuming sums to be unique: there is only one sum of a given set of entities. This assumption sits well with those who have extensional feelings when it comes to mereology. But since some three-dimensionalists reject mereological extensionality, they will look askance at our functional notion of sum. In order to take care of their case, we shall simply say that

(IGW")   something is wholly present at a time *t* iff: *x* exists at *t* and if *x* is complex at *t*, it is identical with *a* sum of its proper parts at *t*.

Let us introduce a non-functional predicate such as:

$S_t(x, \varphi y)$ for   '*x* is a mereological sum at *t* of every *y* such that φy'

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[5] For those who are wondering whether proper temporal parts are parts of objects at times, and whether we should not instead say that they are parts of objects simpliciter, I refer to Sider instructions on how to define temporary parthood in terms of timeless parthood (Sider 2001, 57) or on how to define temporal parts in terms of a primitive notion of temporary parthood (Sider 2001, 59).

which can be defined as follows:

$$S_t(x, \varphi y) \quad := \forall z \, (x \circ_t z \leftrightarrow \exists y \, (\varphi y \wedge y \circ_t z))$$

Whole presence will then be defined as follows:

Whole presence for non-extensionalists

x is wholly present at time $t := x\mathrm{E}t \wedge C_t x \rightarrow \exists z \, (S_t \, (z, [y: y <<_t x]) \wedge z = x)$

What if a material object is more than a sum of its parts? What if a material object is merely *constituted* by such a sum, eventually complemented by a formal constituent as well[6]? Then, to be wholly present at a time will be for the mereological sum of proper parts to be the material constituent of the material object at that time. Let μ be a function from a material object (x) and a time (t) to its material constituent at that time $\mu_t(x)$. Then:

Whole presence for constitution theorists

x is wholly present at time $t := x\mathrm{E}t \wedge C_t x \rightarrow \exists z \, (S_t \, (z, [y: y <<_t x]) \wedge z = \mu_t(x))$

Two remarks are in order. First, notice that the formal principle is not mentioned in the definition of whole presence. Hence, the definition here presented allows us to remain

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[6] For an overview of classic views of this kind, see Rea (1995); for an overview of recent neo-Aristotelian versions, see Baily and Wilkins (2018). Notice that among contemporary neo-aristotelians Fine's theory of embodiment fits the bill. While Koslicki's (2008, 2018) does not. Under the former, the formal component does not constitute the substance in the same way as the material constituent does, but rather 'retains its predicative role' (Fine 1999, 66). Under the latter, substances, even though hylomorphic, *are* identical with mereological sums (of the material and the formal constituent).

agnostic as regards the nature of that formal principle. It could be an Aristotelian form, a principle of unity, a simple condition to be satisfied by the material constituents, and so on. Second, the aim of the aforementioned definition is to take care of the views under which an object is *not* a mereological sum of its parts. However, the definition takes care of the views under which an object *is* identical to a mereological sum of its parts, under the condition that identity is a limit case of constitution – as it is often taken to be (see Rea 1995).

Yet another worry might come from those three-dimensionalists who believe in time travel. For suppose I change the two headlamps of my car and make it travel back to a time *t* when the car still had the original headlamps. In that case, both the old headlamps and the new headlamps are part at *t* of the car. Hence, if there is a sum of all the parts of the car at *t*, it will include both the old and the new headlamps. However, surely enough, the car is not identical to that mereological sum. Even though there are four headlamps that are part of my car at that time, my car is not a car with four headlights. Rather, 'two instances', so to speak, of my car have two headlamps each. Here is a possible solution. Even though the car is not identical to the sum of its parts at that time, it is identical with its 'two instances'. And each 'instance' is identical to a sum of parts that the car has at that time. Hence, it is still true that the car is identical with a sum of some (though not all) of its parts at that time. In other words, in order to take into account such a case we might say that

(IGW''')   something is wholly present at a time iff: x exists at t and if it is complex at t, then it is identical to a sum of some of its proper parts at that time.

Whole presence for time travelers

x is wholly present at time $t := xEt \land C_t x \rightarrow \exists z, ys \ (\forall y \in ys \ (y <<_t x) \land S_t(z, ys) \land z = \mu_t(x))$

§ 3   The new conception of whole presence vis-à-vis its rivals

I shall now argue that the proposed conception of whole presence presents several advantages vis-à-vis other conceptions of whole presence proposed in the literature. I shall proceed in two steps. First, I shall show that the proposed conception avoids Sider's objections. Second, I shall compare the proposed conception with rival definitions which have been proposed in the literature and highlight some clear advantages of the present proposal over its rivals.

Unlike Sider's proposal (S2), the current definition is strong enough to distinguish three-dimensionalism from four-dimensionalism. In general, a four-dimensionalist would not take a four-dimensional object to be identical to a sum of proper parts that an object has at any time of its persistence. At best, a four-dimensionalist would take such a sum to be one of the proper temporal parts of the object at the given time. But since such a sum is a proper temporal part of the object, it is also is a proper part of it, and therefore it is not numerically identical to it.

Unlike another proposal considered by Sider, the current definition is weak enough to allow material objects to change parts throughout their temporal career. Some people might find it strange to say that an object is numerically identical to sums composed by different objects. Indeed, it is still disputed whether *timeless* sums – that is, sums defined in terms of the timeless notion of part – can be identical despite having different parts (van Inwagen 2006, Sanford 2011). But this is not what we are requiring here. The *temporary* notion of sum – that is, the notion of sum defined in terms of the temporary notion of part – requires a changing object x to be identical to a sum at t of the xs and a sum at t' of the zs, where t and t', as well as the ys and the zs, respectively, are different. In turn, this means that

    (i)   everything that overlaps x at t also overlaps one of the ys at t, and vice versa, and

(ii)   everything that overlaps x at t' also overlaps one of the zs at t', and vice versa

As long as things can overlap different things at different times with – that is, things can have different parts at different times – the possibility of having (i) and (ii) together should be secured as well. Finally, unlike a fourth proposal considered by Sider, the proposed conception does not rest on a denial of the claim that material objects have proper temporal parts.

The proposed definition is also preferable to other definitions that have been proposed in the literature. Merricks (1999), for example, defines whole presence along the following lines:

(S5) x is wholly present iff every part of x exists at the present time.

Notice two things. First, Merricks' definition of wholly present is a definition of a monadic predicate, and not of a relation ('being wholly present at'). Second, Merricks is here using the timeless, instead of the temporary, notion of parthood (Merricks 1999, 421). Merricks explains that his definition implies presentism, for non-presentism would make the resulting form of three-dimensionalism inconsistent with material objects' changing their parts (Merricks 1999, 424). Unlike Merricks' definition, the present definition is not committed to presentism and would therefore be of appeal to those who think that presentism is false, or that a definition of three-dimensionalism should be neutral on issues of temporal ontology. One of the most significant recent advancements in the debate on persistence certainly has to do with the application to the debate of the results and conceptual resources developed in the framework of location theory. Pioneering works such as those of Parsons (2000) Gilmore (2006) and Sattig (2006) have allowed us to distinguish two debates, where there seemed to be only one. On the one hand, there is a locative debate concerning the regions of time or spacetime that are occupied by persisting objects. Are persisting objects exactly

located the four-dimensional spacetime region which they cover during their persistence, thereby being singly exactly located four-dimensional entities? Or are they exactly located at all and only the instantaneous regions that make up such a four-dimensional spacetime region, thereby being multi-located three-dimensional entities? On the other hand, there is a mereological debate concerning the mereological structure of such persisting objects. To see that the two debates are different from one another, suppose that persisting objects are singly exactly located at the four-dimensional spacetime region of their persistence. They are four-dimensional entities. And yet, in principle, this leaves open the way in which they divide into parts across this four-dimensional region. A classical option is that they divide into (spatio-)temporal parts, one for each (spatio-)temporal region of their persistence. However, if for example they are extended simples, they might cover such a region without dividing into proper spatiotemporal parts (Parsons 2006).

If the locative dispute is stated clearly enough, what should we say about the mereological one? Understandably enough, some of these scholars focus more on the locative dispute and define the mereological one in usual terms such as a debate as to whether persisting objects have temporal parts (Gilmore 2008, 1227). We have already seen why Sider takes this definition to be unsuccessful. Hence, this paper can be seen as providing a way of covering a problem, namely the definition of the mereological dispute, that has been lately out of focus.

Finally, I shall briefly consider a definition of whole presence offered by Parsons (2007):

(S6) x is wholly present at time t iff every part of x is weakly located at time t

In turn, an entity is weakly located at a time iff the time is not completely free of that entity. If the time in question is an instant, this means that the entity exists at that instant. If the

time in question is an interval, this means that the entity exists at least one instant in the interval. Given this meaning of weak location, it should be clear enough that Parsons' definition is equivalent to definition (S3) discussed above and is therefore incompatible with the mereological change of persisting objects. This result sits well with Parsons' idea that persisting objects are spatiotemporally extended simples. However, once again, it would be good to have a conception of wholly present that us neutral as to whether objects change their parts or are extended simples, and as to which one of the aforementioned locative theories is true. The conception I have offered is indeed one.

Acknowledgements

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