Why neither diachronic universalism nor the Argument from Vagueness establish perdurantism

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Introduction

The central debate in the metaphysics of persistence is that between endurantism and perdurantism. Roughly put, perdurantism is the view that objects persist by having instantaneous temporal parts at every moment at which they exist, while endurantism maintains that objects are 'wholly present' at every moment at which they exist.

More precisely, say that x is an *instantaneous temporal part (ITP)* of y at t iff (i) x exists at, but only at, t; (ii) x is part of y at t; (iii) x overlaps at t everything that is part of y at t. Let *perdurantism* be the view that for every object x and for every time t at which x exists, there is an ITP of x at t and let *endurantism* be the denial of perdurantism.[1]

The Argument from Vagueness (initially proposed by Lewis, and then expanded by Sider) is often taken to be one of the strongest arguments in favour of perdurantism.[2] The argument proceeds in three stages. The first stage concerns the atemporal parthood relation, and aims to establish the (atemporal) doctrine of universalism about composition ('every class of objects has a fusion'). The second stage concerns the temporally-indexed (or, as I call it, 'temporalized') parthood relation. A parallel argument to that of the first stage is presented, but this time the aim is to establish the temporalized or diachronic analogue of the principle of universalism. The third stage aims to establish that diachronic universalism entails perdurantism.[3]

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[1] See Sider (2001), ch. 3 for these definitions. I use the terms 'perdurantism'/'endurantism' for the views that Sider labels 'four-dimensionalism'/ 'three-dimensionalism' respectively. (Note that Sider himself expresses a preference for the former terminology - see *ibid*. pp. xiii-xiv, and p. 68- but opts for the latter in order to conform to common usage.)

[2] The argument is presented in §4.9 of Sider (2001). Sider himself classifies the argument as "one of the most powerful" (p. 120), and Koslicki (2003) maintains that "if it were not for the argument from vagueness, there would be a relative stand-off between three-dimensionalist and four-dimensionalist" (*ibid.,* p. 108, though note that she ultimately rejects the argument).

[3] The first stage is thus not strictly speaking necessary in order to establish perdurantism, but it is important in this context, as it serves as a model for the argument in the second stage.

The argument from vagueness has been widely discussed and widely criticised. Most criticisms have been directed at the first stage of the argument (though by analogy, they are taken to apply to the parallel argument in the second stage as well).[4] A small number of critics have targeted specifically the diachronic part of the argument (the second and third stages).[5] In this paper, I offer a novel criticism of the latter kind. I argue that the correct way to formulate the temporalized analogue of the principle of universalism is a principle I label 'DU-M'. Crucially, DU-M does not entail perdurantism. So if by 'diachronic universalism' we mean (as I think we should do) DU-M, then, diachronic universalism does not entail perdurantism and the third stage of the argument fails.

Sider, however, offers a different (and, I argue, incorrect) formulation of the temporalized analogue of universalism (call his principle 'DU-S'). A natural worry at this stage is that, even if we accept that Sider's principle is not the correct temporalized analogue of atemporal universalism, we can sidestep the issue of how to formulate diachronic universalism, and simply phrase the argument directly in terms of DU-S. After all, if the second stage of the argument establishes DU-S, and the third stage of the argument establishes that DU-S entails perdurantism, then the Argument from Vagueness as a whole succeeds in establishing perdurantism. I respond to this worry by showing that the second stage of the argument does not succeed in establishing DU-S.

In **§1** I provide a brief summary of the argument from vagueness (focusing on the details which are relevant to this discussion). In **§2**, I explain why the correct way to formulate the temporalized analogue of atemporal universalism is the principle I label 'DU-M', rather than Sider's own formulation ('DU-S'). I also show that DU-M does not entail perdurantism and thus, that on the correct way of understanding 'diachronic universalism', the third stage of the argument fails. In **§3**, I show that one cannot avoid the problem by phrasing the argument directly in terms of DU-S: the second stage of the argument does not succeed in establishing DU-S, and thus even if we phrase the Argument from Vagueness directly in terms of DU-S, it fails. The upshot is first, that (properly formulated) diachronic universalism does not entail perdurantism and second, that (independently of how 'diachronic universalism' is understood) the Argument from Vagueness does not establish perdurantism.

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[4] See Korman (2010) for an overview of these criticisms.
[5] See Balshov (2005) and Miller (2005).

§1 The Argument from Vagueness summarised

Consider the atemporal relation of parthood and the corresponding notion of atemporal fusion.[6] Let (atemporal) universalism be the doctrine that any class of objects has a fusion. The first stage of the argument from vagueness aims to establish (atemporal) universalism. In very condensed form, the argument in the first stage goes like this: suppose by contradiction that not every class has a fusion. Then there will be a pair of cases connected by a continuous series such that in one composition occurs, but in the other composition does not occur. But no such continuous series contains a 'sharp cut off': a pair of adjacent cases such that in one composition definitely occurs and in the other composition definitely fails to occur. Thus there are some cases where composition is vague (does not definitely occur and does not definitely fail to occur). But composition can never be vague. So contrary to the supposition, (atemporal) universalism must hold.

Sider has much more to say in support of the various premises of this argument, but we can leave those details aside for the moment. Crucially, though, the perdurantism/endurantism debate is framed in terms of the more neutral notion of part-at-a-time or temporalized parthood. Thus in the second stage, Sider presents a parallel argument which is intended to establish a diachronic analogue of the principle of universalism, one that concerns fusions in the context of temporalized parthood. It turns out that it is less trivial to formulate universalism in those settings. Given the temporalized parthood relation and the corresponding notion of fusion at a time[7], one simple way to formulate universalism would be 'For any time t, every class of objects S has a fusion at t'. But as Sider notes, this principle is fairly weak: it only concerns synchronic fusions of objects at each time. Especially in the context of the debate about persistence, we are interested in true diachronic fusions - fusions of objects across times.

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[6] z is a fusion of a class of objects S iff (i) every member of S is a part of z (ii) every part of z overlaps some member of S.

[7] z is a fusion at t of a class of objects S iff (i) every member of S is a part of z at t (ii) every part of z overlaps at t some member of S.

To that end, Sider defines the notion of 'minimal D-fusion' as follows:[8] Let an *assignment* be a (possibly partial) function *f* from times to classes of objects that exist at those times. Given an assignment *f*, let a *D-fusion* of *f* be an object z, such that for every time *t* in *f*'s domain, z is a fusion at *t* of *f(t)*. Given an assignment *f* let a *minimal D-fusion* of *f* be an object z which is a D-fusion of *f*, and exists only at the times in *f*'s domain. Finally, let 'DU-S' be the thesis that every assignment *f* has a minimal D-fusion. Sider's suggestion is that DU-S is the diachronic analogue of the principle of atemporal universalism.

The second stage of the argument is intended to show that a parallel argument to that of the first stage establishes diachronic universalism (as Sider is thinking of it, DU-S). In very condensed form, the argument in the second stage proceeds like this: if diachronic universalism fails, then there is a pair of cases connected by a continuous series of cases such that in one minimal D-fusion occurs and in the other it does not. But no such continuous series contains a 'sharp cut off': a pair of adjacent cases such that in one minimal D-fusion definitely occurs and in the other minimal D-fusion definitely fails to occur. Thus there are cases where it is vague whether minimal D-fusion occurs. But it can never be vague whether minimal D-fusion occurs, so diachronic universalism must hold. (I return to discuss this part of the argument in §3 below.)

The third and final stage of the argument aims to establish that diachronic universalism entails perdurantism. Relying on the assumption that diachronic universalism is phrased as DU-S, Sider's argument in the third stage proceeds thus: consider any object O and any time *t* at which O exists. Let *f* be an assignment which has only *t* in its domain, and such that *f*(t)={O}. By DU-S, there is an object z which is the minimal D-fusion of *f*. Sider then goes on to argue that z is an ITP of O at *t*. Since O and *t* were arbitrary, every object has an instantaneous temporal part at every moment at which it exists, which is precisely the perdurantist thesis.

The idea that diachronic universalism entails perdurantism raises understandable unease (more on this in §2 below).[9] It is therefore tempting to think that something has gone wrong with Sider's argument that DU-S entails perdurantism. But it is crucial to note that there is

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[8] See Sider (2001), §4.9.2. What I call 'DU-S' is the principle Sider calls 'U' (p. 138).
[9] This unease is expressed for example by Koslicki (2003), p. 122, but Koslicki does not explain where Sider's argument in the third stage goes wrong.

only one potentially controversial step in this part of the argument (the rest follow directly from the definitions).[10] DU-S directly entails the existence of the fusion z as above, and what remains to be shown is that z is an ITP of O at t. The only not-entirely-trivial step in this inference involves showing that z is part of O at t. Sider appeals here to a very standard principle of mereology, the principle of Strong Supplementation (SSP)[11]: if x is not a part of y at t, then x has some part at t that does not overlap y at t. By definition of 'fusion at t', z overlaps at t every part of O at t, so by contraposing SSP, z is a part of O at t.

Thus the only way for an endurantist to resist the claim that DU-S entails perdurantism is to reject SSP.[12] But this way of resisting the argument may not be particularly attractive. First, as noted above, SSP is a very widely accepted doctrine of mereology, even amongst endurantist or those who otherwise reject classical mereology.[13] Second, it turns out that against the background of universalism, one would need to reject not only SSP but also the even more widely accepted principle of Weak Supplementation (WSP).[14] Finally, as Sider notes elsewhere, while an endurantist who rejects SSP can deny that z is an ITP of O they must nevertheless accept the existence of the fusion z. This means accepting not only the existence of an instantaneous object co-located with O at t, but even more controversially, accepting that the enduring object O is part of this instantaneous object at t.[15]

Denying that DU-S entails perdurantism is thus not a very attractive way of blocking the Argument from Vagueness. For the remainder of the paper, I will accept that DU-S entails perdurantism but show that the Argument from Vagueness nevertheless fails.

§2 How to correctly formulate diachronic universalism and why (properly formulated) the principle does not entail perdurantism

[10] Varzi is thus wrong when he claims that "there are no obvious reasons why an endurantist should reject UDC" (Varzi (2007), p.3. 'UDC' is Varzi's term for what I call 'DU-S').

[11] He refers to this principle as 'PO'.

[12] See Simons (1987) and Magidor (*forthcoming*) for endurantist views that opt for this option.

[13] See Cotnoir (2013).

[14] See Varzi (2009) and Cotnoir (2014). WSP is the principle that if x is a proper part of y at t, then there exists a part of y at t, that does not overlap x at t. The problem (following Varzi) is that given universalism, there exists an object (call it 'Oz') which is the fusion of O and z at t. O is a proper part of Oz (they cannot be identical because, we are assuming, z is part of Oz but not of O). But since z is the fusion of {O} at t, Oz does not have any part that does not overlap O at t.

[15] See Sider (2003), p. 136. It is interesting to note, however, that the standard perdurantist view accepts precisely this: namely that the persisting object O is part at t of its ITP at t. (Relatedly, note that since the standard perdurantism accepts that at any moment t a persisting object is part of its ITP at t and vice versa, the perdurantist rejects the anti-symmetry of temporalized parthood, and more generally does not accept classical mereology for the temporalized parthood relation).

Let us take a step back. On the face of it, it is highly surprising that universalism about composition would entail perdurantism. After all, universalism is intuitively a thesis that tells us something about how we can fuse together existing objects into new objects, while perdurantism is a thesis about how we can divide up existing objects into their parts. One way to develop this worry is to note that there is a substantial disanalogy between Sider's principle DU-S, and the original atemporal principle on which DU-S is modelled.

To see this, let us leave the temporal dimension aside for a moment and consider composition across space. Suppose we are concerned with the question of when objects in particular spatial locations have a fusion. The analogue of Sider's principle DU-S would be the following principle of 'Spatial Universalism' (SU-S):

Let an *s-assignment* be a (possibly partial) function f from points of space to classes of objects that exist at those points. Given an s-assignment f, let an *S-fusion* of f be an object z, such that for every point p in f's domain, z is a fusion at p of $f(p)$.[16] Given an s-assignment f let a *minimal S-fusion* of f be an object z which is an S-fusion of f and exists only at points in f's domain. Finally, let *spatial universalism* (SU-S) be the thesis that every s-assignment has a minimal S-fusion.

It is crucial to notice is that SU-S is a very strong principle: it has surprising consequences that certainly do not follow from standard universalism about composition. For example, SU-S entails that there are point sized-objects and moreover, that *every* occupied point of space contains a point sized-object. For let O be any object and p be a point of space it occupies. Let g be an s-assignment that has only p in its domain, and such that $g(p)=\{O\}$. By SU-S, g has a minimal S-fusion z and by the definition of 'minimal s-fusion' it follows that z exists at p and only at p, and hence that it is a point-sized object. But clearly, nothing of the sort follows for ordinary universalism about composition: one could, for example, be a universalist and maintain that all material objects occupy extended regions of space. For similar reasons, we should be wary of Sider's formulation of diachronic universalism in terms of DU-S: DU-S entails that we can divide existing objects into instantaneous slices, but intuitively nothing of the sort should follow from universalism about fusions.

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[16] To make sense of this definition, we would need to define the notion of fusion at a point, but the worry I raise does not depend on how exactly this notion is defined (the problem relies only on the second clause in the definition of 'minimal S-fusion').

Reflecting on these worries should help clarify how diachronic universalism ought to be correctly formulated. Let us start by considering how a perdurantist who accepts atemporal universalism thinks about such atemporal fusions. Suppose for example A is a building located in Paris which exists between the years 1980 and 2000, and B is a building located in London which exists between the years 1990 and 2010. According to the theorist in question, the fusion of A and B will be an object C which exists between the years 1980 and 2010, is located in Paris in the first ten years of its life, then scattered between London and Paris, and finally located in London only for ten years.

Reverting now to the temporalized notions, we want to think of diachronic fusion in a way that is as analogous as possible to the atemporal notion. For example, we should require that the fusion of a set of objects exists exactly when at least one of those objects exist, and that at every moment of its existence it overlaps each of the objects in the set that exist at that moment.

It is not hard to see how to get a definition that achieves just that. Let S be a class of objects. Let a *D*-fusion* of S be an object z s.t. (i) z exists exactly when at least one object in S exists and (ii) at each time t at which z exists, z is the fusion at t of $S_t = \{x \epsilon S: x \text{ exists at } t\}$. Finally, let the amended) principle of diachronic universalism (DU-M) be the claim that every class objects S has a D*-fusion.

I maintain that it is DU-M, rather than DU-S, which is the correct temporalized analogue of atemporal universalism. For example, DU-M would entail the existence of a (D*-)fusion C of the two buildings described above, and C would have just the right properties (clause (i) ensures it exists from 1980 until 2010, while clause (ii) will ensure it is co-located with building A for the first ten years of its life, scattered for the next ten years, and then co-located with building B for the final ten years).

Moreover, it is easy to see that DU-M does not entail perdurantism: it is perfectly consistent with DU-M that there are no instantaneous objects at all, let alone no instantaneous temporal parts. I conclude that the correct way to formulate diachronic universalism is DU-M and that, properly formulated, diachronic universalism thus does not entail perdurantism.[17] The initial misgivings about what the third stage of the argument purports to show (namely, that

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[17] Though, of course, DU-M is *compatible* with perdurantism.

diachronic universalism entails perdurantism) were correct. But the third stage of the argument fails not because of a flaw in Sider's argument that DU-S entails perdurantism, but rather because DU-S is not the correct way to formulate diachronic universalism.

§3 Why the second stage fails to establish DU-S and hence the Argument from Vagueness fails to establish perdurantism

Even if one accepts my argument so far, a natural worry suggests itself at this point. We can put aside the question of which principle is the correct temporalized analogue of atemporal universalism, and simply phrase the Argument from Vagueness directly in terms of DU-S. I have already conceded (at least for the purposes of this paper) that DU-S entails perdurantism. If we also accept that the second stage of the argument establishes DU-S, then the Argument from Vagueness as a whole establishes perdurantism.

In this section, I argue that the second stage of the argument does not successfully establish DU-S[18] and thus the Argument from Vagueness does not establish perdurantism.

The discussion in the previous section gives us reason to at least be highly suspicious of the argument in the second stage: after all, the temporalized version of the argument at this stage is presented as highly parallel to the atemporal version of the argument in the first stage: the three premises of the argument in the second stage (quoted below) are almost word-to-word identical to the premises in the first stage (except that the atemporal phrase 'composition occurs' is replaced with temporalized notion 'minimal D-fusions occurs'), and much of Sider's (brief) justification of the revised premises relies on this parallelism.[19] But in so far as we are to take these parallels seriously, this should raise some major red flags concerning the cogency of the argument in the second stage. First, because the argument in the first stage is used to establish atemporal universalism which does not entail perdurantism (atemporal universalism is consistent, e.g., with a world in which there are no instantaneous objects), and

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[18] I am not claiming here that second stage *does* establish DU-M because of independent misgivings about the argument, but these need not concern us here.

[19] Indeed, Sider opens his discussion of the temporalized version with the following remark, which suggests that the sole purpose of the temporalized version is to argue for universalism in terminology that is neutral between three and four dimensionalists: "*The argument of the previous section concerned the question of when a given class has a fusion, where 'fusion' was understood atemporally. To avoid begging any questions against my opponents, the argument fortemporal parts will be states using temporally qualified mereological terms*" (*ibid*. p.132).

so it would be highly surprising if the temporalized analogue of the argument establishes a principle (DU-S) which *is* sufficiently strong to entail perdurantism. Second and relatedly, we have seen the closest temporalized analogue of atemporal universalism is DU-M rather than DU-S. So in so far as the temporalized argument is supposed to be an analogue of the original, it should be run using the notion of a DU*-fusion rather than that of a minimal D-fusion, and (at best) would establish DU-M rather than DU-S.

While the above considerations give us reasons to be prima facie very suspicious of the argument in the second stage, this falls short of a conclusive reason to reject the argument. After all, in the second stage of the argument Sider presents an explicit argument in favour of DU-S (he isn't *just* relying on the analogies with the first argument), so it would be instructive to see where exactly the argument goes wrong. For the remainder of the paper I address this issue. Doing so requires a more detailed look at Sider's discussion.

The argument in the second stage relies on the following three premises (which are direct analogues of P1-P3, the premises of the argument in stage one):

> P1′: If not every assignment has a minimal D-fusion, then there must be a pair of cases connected by a 'continuous series' such that in one, minimal D-fusion occurs, but in the other, minimal D-fusion does not occur.

> P2′: In no continuous series is there a sharp cut-off in whether minimal D-fusion occurs.

> P3′: In any case of minimal D-fusion, either minimal D-fusion definitely occurs, or minimal D-fusion definitely does not occur.

Several remarks are in order. Regarding P1′, Sider begins by clarifying how the notion of a 'continuous series of cases' should be interpreted in the current context: "*A 'continuous series of cases' will now vary in all respects thought relevant to whether **a given assignment** has a minimal D-fusion, including spatial adjacency, qualitative similarity, and causal relations at the various times **in the assignment**, as well as the beginning and cessation of these factors at various times of **the assignment***" (*ibid.* 134, my emphasis). A crucial point to note is that as Sider is construing things all cases in one continuous series involve *the same assignment* (the cases vary merely in the properties and relations amongst the objects participating in the assignment). He goes on to say that the justification of P1′ parallels that of the corresponding premise P1 of the atemporal argument,

making a note that nihilists can resist P1′ (since Sider rejects nihilism for independent reasons, he is not troubled by this).

With regards to P2′, Sider discusses in detail only one potential counterexample: a certain version of mereological essentialism (since Sider rejects essentialism for independent reasons, he is not troubled by this).[20] His thought is that given essentialism, one can give a precise but non-trivial restriction for which assignments have minimal D-fusions: "*an assignment has a minimal D-fusion roughly, when, and only when it is the temporally longest assignment for a given fixed class of objects. The idea is that mereological fusions of objects 'automatically' come into existence when their parts do, automatically retain those same parts, and automatically go out of existence when any of those parts go out of existence*" (*ibid.*, p. 135). It is important to note two things here: first, it is rather odd to justify a universal principle such as P2′ (and for that matter the corresponding premise P2) by rebutting only one potential counterexample. This is especially striking since on the face of it there are indefinitely many fully-precise restrictions that one can define on composition or on when minimal D-fusion occurs! (For a start, we can require that minimal D-fusion occurs just in case the domain of the assignment is an interval of at least 1 minute, 2 minutes, and so forth). Of course, for each precise restriction there remains the question of whether adopting it would result in a plausible metaphysical view, but one would expect that considering the wide range of potential restrictions and their respective plausibility requires much more discussion that Sider's brief remarks on essentialism offer. Second, given the way that Sider defines a continuous series of cases, it is unclear why he thinks essentialism provides a counterexample to P2′ rather than to P1′: if a continuous series involves a single assignment *f*, then either *f* corresponds to "the temporally longest assignment for a give fixed class of objects" (in which cases it has a minimal D-fusion for any case in the series), or it does not (in which case it does not have a minimal D-fusion for any case in the series). As with nihilism, essentialism is at best a threat to P1′. In light of this issue, one might wish to offer a different interpretation of Sider's argument – one according to which cases along a continuous series can also vary in which assignment is involved. Below I will criticise the argument on either variant.

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[20] Sider also briefly mentions a second potential counterexample: a view which restricts the domains of D-fusions to continuous intervals (*ibid*. p. 136). He dismisses this view on the grounds that, as he sees things, it is both unmotivated and would establish something close enough to four-dimensionalism.

Sider's justification for P3′ echoes, again, his justification for the corresponding premise P3. Very roughly, Sider's claim is that vagueness about whether a set of objects compose a further object makes for vagueness of how many objects exist (call this kind of vagueness 'count indeterminacy'). Thus for example, if A and B exist but it is vague whether they have a fusion, then it seems vague whether there are only two or three objects in our ontology. Furthermore, Sider maintains, questions about how many objects there are can be phrased in the fully precise terminology of first-order logic, and thus cannot be vague. However, even if we buy this line in support of the original P3, the justification for the revised P3′ is trickier because although the premise involves a temporalized notion of fusion, it is crucial to Sider that the premise denies vagueness of *atemporal* existence. (After all, plausibly, it is only atemporal existence which can be phrased using purely logical terminology.) Sider does not offer a general argument for why any case of vagueness in minimal D-fusion would result in such atemporal count-indeterminacy. Rather, he offers several paradigmatic cases in which a denier of universalism is likely to argue that there is vagueness in whether minimal D-fusion occurs, and argues that these cases would make for count-indeterminacy. Let me mention here two of his cases:

Scattered Particles: suppose the world contains only a finite set S of *n* particles, which are highly scattered at all times, except for a single time *t* at which they are moderately scattered. Consider the assignment that has only *t* in its domain, and where $f(t)=S$. One might be tempted to think that it is vague whether *f* has a minimal D-fusion, but then it would be vague whether the world (atemporally) contains *n* or (at least) $n+1$ objects.

Young and Old Ted: suppose that the world contains two person-like objects: Young-Ted which exists at t, and Old-Ted which exists at t′ (for simplicity, suppose that no other times are relevant to the case). Suppose that Young-Ted is in some respects psychologically similar or connected to Old-Ted, and in other respects psychologically different or disconnected. Consider an assignment *f* such that $f(t)=$Young-Ted and $f(t')=$Old-Ted. One might be tempted to think that it is vague whether *f* has a minimal D-fusion, but again – vagueness about this question will make for vagueness concerning whether there are only two or three objects involved in this case.

With this exposition of in place, let me proceed to show why the argument fails. Sider mentions only one potential counterexample to P1′ (the nihilist one), although as I mentioned

above, given his definition of 'continuous series of cases', essentialism should provide him with a second counterexample. It is crucial to see why each of DU-S, essentialism, and nihilism manage to avoid the conclusion that there is a pair of cases, connected by a continuous series of cases, which differ on the question of whether minimal D-fusion occurs. Recall that by Sider's definition of a 'continuous series of case', the cases in a series do not vary with respect to which assignment is involved, only with respect to the properties and relations among the objects participating in the assignment. Thus *any* restriction on composition which only takes into account the issue of which objects exist at each time (and not their particular arrangement, causal relations, etc.) will achieve the result that, for any series of cases, minimal D-fusion either occurs in all cases in the series or it occurs in none, and the consequent of P1′ will fail. But once this point is recognised, it is easy to see that one need not revert to radical views such as nihilism or essentialism to avoid this consequent.

In particular, it is easy to generate counter-examples to P1′ against the backdrop of DU-M: suppose that the world is not gunky. It contains only a finite number of non-instantaneous simples and all the D*-fusions that are necessitated by these via DU-M. This scenario satisfies the antecedent of P1′ (any assignment that has a single instant in its domain will have no minimal D-fusion, and hence this proposal violates DU-S), but will violate the consequent of P1′ (since, here again, any assignment either has a minimal D-fusion or doesn't independently of any properties of the objects involved in the assignment – all that matters here is which objects exist at each moment). Yet this is also a mereology which is neither nihilist nor essentialist (it is not nihilist because it contains composite objects, and it is not essentialist because, for example, if we let O3 be the D*-fusion of a simple O1 which exists from t_1-t_2 and a simple O2 which exists from t_2-t_3, then O3 loses O1 as a part while gaining O2 as a part).[21] Moreover, this seems like a rather natural mereological picture.

Given Sider's definition of a continuous series, P1′ (and hence the argument as a whole) fails. But perhaps (as I suggested above) one can offer an alternative and more charitable definition: suppose that we interpret the notion of a 'continuous series' more liberally, so

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[21] Suppose one wanted to have a mereology that further satisfied this constraint: there is an object x and an object y, such that there is a time t where x is part of y, and there is a time t' when x and y both exist, but x is not a part of y. (Plausibly, this feature is needed in order to support an ontology of ordinary objects.) Note that there are a multitude of further restrictions (compatible with DU-M) which would achieve this, and still violate P1′. (For example, suppose that in addition to objects postulated above we required that any assignment that for any moment in its domain had a set containing exactly two simples in its range had a minimal D*-fusion…)

'cases' along the series can differ in which assignment they concern. The most plausible way to do so is to allow for assignments which vary slightly in their domain. Taken this way, P1′ is likely to be true. Assume for example, that there is some object O that has no ITP. Then let f_1 be an assignment which has in its domain all the moments of O's entire life-time, and where for each t in f_1's domain $f(t)=\{O\}$. We can look at a series of similar assignments with temporally shorter domains, and one of them is bound to have no minimal D-fusion.[22] However, on this amended version, similar considerations as above should cause us to seriously doubt P2′.

It is hard to conclusively refute P2′, because we do not have any firm diagnosis on what would constitute a 'sharp cut-off' in a series of cases.[23] But Sider's own remarks on why he takes essentialism to be inconsistent with P2′ provide us with an idea of what kinds of positions he takes to make for counterexamples to the premise. Sider suggests that given essentialism, one can propose the following condition on when composition occurs, which he takes to be non-vague: "*an assignment has a minimal D-fusion just in case it is the temporally longest assignment for a given fixed class of objects*" (*ibid.* p.135).[24] But as above, Sider has not given us any argument for thinking the essentialist condition is the only non-trivial one which would allow for non-vague cases of composition. Perhaps most notable is that for anyone who accept DU-M, there is a very natural condition on offer: an assignment f has a minimal D-fusion just in case there is some class of objects S, such that (i) the domain of f includes all and only the times at which some object in S exist. (ii) for each time in f's domain, the fusion-at-t of $f(t)$ is identical to the fusion-at-t of S.[25] This condition is structurally parallel to the one that Sider proposes in the case of essentialism, and thus if the

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[22] On the simplest picture any assignment in the series other than f_1 will have no minimal D-fusion. But we shouldn't jump this conclusion: the object O might have temporal proper parts without having instantaneous temporal parts.

[23] In particular, note that there might be cases for which we cannot establish whether or not composition occurs, even though it is not vague whether composition occurs. (See Hawthorne (2006), pp. 104-109).

[24] More precisely, Sider defines an equivalence relation between ordered pairs of sets of objects and times ($<S_1,t_1>$ is equivalent to $<S_2,t_2>$ iff every part-at-t_1 of every member of S_1 overlaps-at-t_2 some member of S_2 and every part-at-t_2 of every member of S_2 overlaps-at-t_1 some member of S_1), and then maintains that f has a minimal D-fusion just in case f is the maximal equivalence-interrelated assignment.

[25] At a first pass, we could have simply required that at t, $f(t)=S$, but this will rule out cases where $f(t)$ consists of another way to decompose the objects in S. (This complication is exactly analogous to the reason Sider needed to specify the equivalence relation in his essentialist restriction - see n. 24 above.)

essentialist condition is taken to be non-vague, so should this one.[26] (In fact, interestingly, although this condition does not entail essentialism, it also fits Sider's rough gloss on the essentialist view - "the temporally longest assignment for a give fixed class of objects" - except that here we do not require that the objects in question are composed of the same parts at all times). Accepting this condition is equivalent to accepting DU-M, and thus it would be only available to those who are willing to accept the principle, but anyone such as Sider which already accepts atemporal universalism would not find this principle objectionable.[27] Thus Sider's argument for P2′ fails as well.[28]

My criticism is thus that depending on how the notion of a 'continuous series' is defined, Sider fails to establish either P1′ or P2′. I will not directly object here to P3′, which states that it can never be vague whether a minimal D-fusion exists. Nevertheless, recall that Sider justifies the premise by presenting some particular cases where, he takes it, objectors to DU-S would typically want to say that it is vague whether a D-fusion exists and maintains that this in turn forces them to the unpalatable verdict that the cases involve count-indeterminacy.

If Sider is right about these cases, then they can be used as a direct argument in favour of DU-S (if anyone who rejects DU-S must accept that these cases make for count-indeterminacy, then assuming count-indeterminacy is impossible, DU-S must be accepted). However, I will now explain why, contra Sider, an objector to DU-S need not accept that in the cases he presents there is vagueness in whether a minimal D-fusion exists, or indeed any corresponding count-indeterminacy.

Consider first the case of *Young and Old Ted*. Any theorist that accepts DU-M (even if they do not also accept DU-S), would accept that the relevant assignment has a minimal D-fusion and thus no vagueness is involved. The case of *Scattered Particles* is slightly trickier: assuming DU-M, there is an object which fuses all the scattered particles throughout their

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[26] Note that is will not do to claim that this condition isn't sufficiently non-vague because it relies on the question of which objects exist at various times: the same is true of Sider's restriction in the case of essentialism, which he takes to be sharp.

[27] Moreover, Sider's DU-S entails DU-M, so by accepting DU-S he is committed to the principle.

[28] My criticism of Sider's argument for P2′ here is thus related to that of Balshov (2005). Balshov presents a particular example of two 'adjacent' cases such that in one minimal D-fusion definitely occurs and in the other it does not. The first involves the assignment $f = \{<t,\{a\}>: t$ is a member of a's entire lifetime$\}$, and the second involves an assignment just like f but where some arbitrary pair is excluded. Balshov's example is merely an instance of the general restriction I propose: in the first case minimal D-fusion does occur, because it corresponds to the D*-fusion of some set of objects (in this case, the singleton set $\{a\}$), while in the second case there may well not be any set of objects corresponding to f.

lifetime. However, it is consistent with DU-M that there is also *another* object that fuses those particles and exists only at *t* (and of course also consistent with the principle that there is no such object), and thus DU-M does not in itself settle the question of whether the assignment in question has a minimal D-fusion. This, however, does not mean that it is *vague* whether the assignment in question has a minimal D-fusion, or indeed vague how many objects exist: all we can conclude is that merely adopting DU-M underspecifies the question of which objects exist.

Moreover, note first that there are various ways to expand DU-M in precise ways that would fall short of adopting DU-S but would completely settle this issue.[29] Second and more importantly, Sider's own principle DU-S does not escape a similar kind of under-specificity: for example, it does not specify whether there are any gunky objects or how many simples there are in the first place – all questions which can make a difference to count-facts. Taking any such underspecificity as an instance of the Argument from Vagueness, risks massive overgeneration of the argument. To put the point another way, suppose that someone tried to defend Spatial Universalism discussed above, using the following argument:

> Consider a scenario involving one particle which occupies two points in space. Merely adopting DU-S does not tell us whether that particle has a point size part or not. If it doesn't, our ontology would contain at least two objects, but otherwise it would contain only one. So, DU-S leaves us with count indeterminacy, and hence we should adopt SU-S.

This argument is no doubt too quick, but it is highly parallel to Sider's argument for DU-S. The upshot is that views about composition (including Sider's own view) need not entail the precise cardinality of the domain. If a view about composition does not (without further assumptions) determine the cardinality of the domain this does not mean that the view entails that there is vagueness or indeterminacy regarding this cardinality.

The discussion of the details of Sider's argument has been rather complex, so let me summarise it more briefly: Sider fails to show that adopting DU-S, essentialism, or nihilism are the only three ways of blocking the existence of a continuous series of cases with no sharp cut-offs: other restrictions on composition (in particular, rather natural ones which are based on DU-M), can achieve the same results. Admittedly merely adopting DU-M doesn't in

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[29] Thus, for example, if the only objects available are non-instantaneous simples and their D*-fusions, the question would be settled negatively.

itself settle every question about how many objects there are in each scenario, but we shouldn't expect this out of a view on composition and at any rate, the same holds of DU-S. A defender of perdurantism could try to develop the Argument from Vagueness by showing, for every single restriction which does not entail DU-S, that it leads to an implausible metaphysical picture (as was Sider's strategy with nihilism and essentialism). But that would require a very different argument then the one at hand. As it stands, the Argument from Vagueness does not establish DU-S, and thus fails to establish perdurantism.[30]

References

Balshov, Y. (2005), 'On vagueness, 4D, and diachronic universalism', *Australasian Journal of Philosophy* 83: 523-531.

Cotnoir, A. (2013), 'Strange parts: the metaphysics of non-classical mereologies', *Philosophy Compass* 8: 834-845.

Cotnoir, A. (2014), 'Does universalism entail extensionalism?', *Nous* 48:1-12.

Hawthorne, J. (2006):   *Metaphysical Essays*, Oxford: Oxford University Press.

Korman, D. (2010), 'The argument from vagueness', *Philosophical Compass* 5: 891-901.

Koslicki, K. (2003), 'The crooked path from vagueness to four-dimensionalism', *Philosophical Studies* 114: 107-34.

Magidor, O. (*forthcoming*), 'Endurantism vs. Perdurantism?: A debate reconsidered', *forthcoming in Nous*.

Miller, K. (2005), 'Blocking the path from vagueness to four-dimensionalism', Ratio 18: 317-381.

Sider, T. (2001), *Four-Dimensionalism*, Oxford: Oxford University Press.

Sider, T. (2003), 'Against vague existence', *Philosophical Studies* 114: 135-146.

Simons, P. (1987), *Parts: A Study in Ontology*, Oxford: Clarendon Press.

Varzi, A. (2007), 'Promiscuous endurantism and diachronic vagueness', *American Philosophical Quarterly* 44: 181-189.

Varzi (2009), 'Universalism entails extensionalism', *Analysis* 69: 599-604.