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Ontological dependence in a spacetime-world

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Abstract Priority Monism (hereafter, 'Monism'), as defined by Jonathan Schaffer (Philos Rev 119:131–176, 2010), has a number of components. It is the view that: the cosmos exists; the cosmos is a maximal actual concrete object, of which all actual concrete objects are parts; the cosmos is basic—there is no object upon which the cosmos depends, ontologically; ontological dependence is a primitive and unanalysable relation. In a recent attack, Lowe (Spinoza on monism. Palgave Macmillan, London, pp 92–122, 2012) has offered a series of arguments to show that Monism fails. He offers up four tranches of argument, with different focuses. These focal points are: (1) being a concrete object; (2) aggregation and dependence; (3) analyses of ontological dependence; (4) Schaffer's no-overlap principle. These are all technical notions, but each figures at the heart of a cluster of arguments that Lowe puts forward. To respond, I work through each tranche of argument in turn. Before that, in the first section, I offer a cursory statement of Monism, as Schaffer presents it in his 2010 paper, *Monism: The Priority of the Whole*. I then respond to each of Lowe's criticisms in turn, deploying material from Schaffer's 2009 paper *Spacetime: the One Substance*, as well as various pieces of conceptual machinery from Lowe's own works (The possibility of metaphysics. Clarendon, Oxford, 1998, 2010) to deflect Lowe's (Spinoza on monism. Palgave Macmillan, London, pp 92–122, 2012) attacks. In the process of defending Monism from Lowe (Spinoza on monism. Palgave Macmillan, London, pp 92–122, 2012), I end up offering some subtle refinements to Schaffer's (Philos Rev 119:131–176, 2010) view and explain how the resulting 'hybrid' view fares in the wider dialectic.

Keywords Ontological dependence · Priority monism · Spacetime · Schaffer · Lowe

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1 Introducing priority monism

Monism is the thesis that 'the world' or 'the cosmos' is the single fundamental concrete object, upon which all other concrete objects, that are parts of this fundament, depend for their existence.
In Schaffer's words:

> The *monist* holds that the whole is prior to its parts, and thus views the cosmos as fundamental, with metaphysical explanation dangling downward from the One. (2010: 31)

This monistic thesis is more fully explicated via the following semi-formalisation. To start with, allow the following:

Pxy = x is a part of y
Dxy = x depends on y
u = the cosmos

Schaffer makes it clear (2010: 38) that he is interested only in concrete objects, and allows that 'C' stands for the predicate 'is concrete'. Since Schaffer maintains that every concrete object is a part of the cosmos, allow that 'P' stands for the predicate 'is a part of', then:

$$Cx = Pxu$$

This facilitates an expression of the thesis that the cosmos is basic:

$$Bx = Cx \ \& \ \sim (\exists y)\ (Cy \ \& \ Dxy)$$

That, in turn, allows us to give a formal statement of Monsim.

$$\text{Monism} = \text{df}\ (\exists!x)\ Bx\&Bu$$

In words: there exists a single object that is basic and is that is the cosmos.
Of course, to say that one object is *basic* allows that there exist non-basic objects. According to Schaffer, in addition to basic objects, there exist derivative (or, non-fundamental) objects. These objects are parts of the monistic whole, and include things like tables, chairs and other, familiar macroscopic objects (cf. 2010: 33).

Although a cursory sketch, this gives us enough of a handle on Monism to be going on with. I will now move to consider Lowe's objections. As I've already indicated, I will draw upon some more of the details of Schaffer's view, particular material that is developed in Schaffer's (2009). In various places, I also borrow from Lowe (1998, 2010) to show how relevant metaphysical notions can be brought to bear to solve the problems that Lowe himself raises. I also offer a refinement of Schaffer's view of ontological dependence

2 Is there a cosmos? Is it a concrete object?

As we saw, Schaffer claims that the cosmos is a concrete object. It is (obviously) then essential that we return the verdict that the cosmos *is* both concrete and an object. But Lowe (2012: 93) raises a concern on this score, challenging Schaffer as to what he means by 'concrete object' and what he means by 'the cosmos'. Lowe claims (2012: 93–94, 95) that Schaffer never really specifies what he means by 'concrete object' and argues that this generates a problem. To try to press home this concern, Lowe offers a number of distinct considerations.

The first move that Lowe makes (2012: 93) is to express general doubts about whether or not the cosmos could properly be regarded as an object. Roughly: Lowe doesn't see that a cosmos is the kind of thing that should qualify as an 'object' given our natural and intuitive views about object-hood.

Second, Lowe concedes that one might be motivated to think that there *could* be such an object as the cosmos, if one endorsed a view of composition—universalism—according to which every plurality of concrete objects has a maximal mereological sum. Since Lowe denies universalism this looks like a no-go. I'm not so troubled by this move from Lowe. In the paper, Lowe says nothing to support his rejection of Universalism. I'll say nothing, here, to defend my adoption if it, either. We'll treat this as a point of disagreement between us; I will say nothing more on this.

(Note, this is not a radically uncharitable move since, as we shall see, Lowe thinks that even if we grant Universalism, we should still not adopt Monism. For, e*ven if* we allowed Universalism, Lowe does not think that Monism would be a plausible outcome, as the resulting composite object would be a mereological sum, and 'my own view is that a mereological sum is always ontologically posterior to the items of which it is the sum'. I return to this point, later (Sect. 3), for it requires me to first discuss Schaffer and Lowe's competing views of ontological dependence.)

Third, Lowe claims that Schaffer (2010) has too little to say in explicating the notion of 'the cosmos', and, perhaps most pressingly, what does get said doesn't satisfy. In particular, here is Schaffer (2010: 34):

> Empirically, the cosmos is the object of empirical study. Indeed it is the primary subject matter of physical cosmology

As I say, this cuts no ice with Lowe (2012: 93):

> This strikes me as rash. As I understand it, scientific cosmology is a branch of *physics*—one which specifically studies the large-scale structure of spacetime and the distribution of mass-energy across it.

Fourth, Lowe (2012: 95) then worries explicitly about the notion of 'concreteness' as it applies to Schaffer's metaphysic.

> He tells us that he uses 'C' to express the status of being a concrete object, defining this as follows: Cx = Pxu –that is, by definition, *x* is a concrete object if and only if *x* is a part of the cosmos. Since he has so far told us only that 'the

> cosmos' is the 'maximal concrete object', this 'definition' is far from illuminating—indeed, it is implicitly circular.

None of these four objections should concern us.

I need to begin with the third objection—the objection that challenges the idea that the cosmos is an object of study in physical cosmology (Sect. 2.2). This will allow me to explicate the notion of 'cosmos as spacetime' in full and explain how the cosmos *is* the proper study of physical cosmology (Sect. 2.2). Discussion of this case will also allow me to reject Lowe's claim that we should doubt that the cosmos is an object (Sect. 2.3). Lastly, (Sect. 2.4) this will enable me to show how it is that—by Lowe's owns standards—the cosmos (the spacetime) is concrete.

2.1 The spacetime-cosmos

The view that Schaffer (2009) defends is that spacetime *itself* is a substance and, relatedly, that this substance is Monistic. There are two different parts of this thesis that deserve our attention. Our first concern is a basic statement of the thesis that spacetime is intended to be understood as a single substance.

> Spacetime is substance enough. There is no need for the dualism of the contained and the contained (or for fundamental containment relations). When God makes the world, she need only create spacetime. Then she can pin the fundamental properties directly to spacetime. (2009: 133)

The second thing that we require is a statement of (what Schaffer calls) the identity thesis, which:

> identifies material objects with spacetime regions. (2009: 133)

Putting these two theses together:

> I am presupposing that spacetime regions are one sort of substance. I am asking whether or not material objects should be thought of as a second sort of substance. I will be defending the monistic view. In particular I will be defending the identity view, which is the version of monism that identifies every spacetime region with a material object. On this view there is no distinction between the container and the contained. (2009: 133)

I don't mean to discuss (here) *why* he thinks that this is so; merely *that* Schaffer takes this view will be enough for our purposes (the interested reader is encouraged to pursue Schaffer's (2009) rationale). We now have in-hand Schaffer's account of Monism as the thesis that spacetime is the one substance.

2.2 Is the cosmos studied?

Our first question, then, is whether or not spacetime—the cosmos—is studied by physical cosmology. Here, it seems, that Lowe is simply incorrect—at least, *that* he is incorrect is revealed once we allow that the spacetime substance *is* the cosmos. There are a number of studies of spacetime. Indeed, according to General Relativity,

spacetime is supposed to exhibit curvature in the presence of matter. If physics did not study x, then it would seem unlikely that physics would ascribe properties to x. On the basis that physics ascribes properties to spacetime (exhibiting curvature in the presence of matter, for instance), it would seem reasonable to suppose that physics studies spacetime. So, spacetime is studied by physics. Let us suppose that x's being studied by physics is some reason to believe that x exists (if x appears to be being studied by y (where y is a legitimate scientific discipline), that is some evidence that x *is* studying y, and since y cannot study x if x does not exist, so this gives us some (defeasible) reason to suppose that x exists). Thus, we now have some reason to think that spacetime exists. Schaffer identifies the cosmos with spacetime (and in what follows I will use the terms interchangeably). As such, there is reason to think that the cosmos exists and that the cosmos is studied by physics.

2.3 Is the cosmos an object?

We can now move on to the question of whether or not the cosmos is an object. Here Lowe is quite right to note that Schaffer does not say what it is to be an object. But Lowe (1998: 37) does, and I think that we can use that to respond to Lowe's own concerns about Monism.

> 'What is an object?'. As I have already indicated, the answer I have in mind here is simply that to be an *object* is to be an entity possessing *determinate identity-conditions* (though not necessarily a *criterion* of identity, for the reason just given). By this account, if *x* and *y* are *objects*, there must be a 'fact of the matter' as to whether or not *x* is identical with *y*.'

By this measure, a spacetime will be classified as an object.

To demonstrate: the cosmos—the one fundament—is at least a mereological sum. It seems straightforward that there will be 'facts of the matter' as to whether or not one mereological sum is identical to another (for if x is a part of y, and x is not a part of z, then x is not identical to z). That being the case, by Lowe's own standards, the cosmos is an object.

2.4 Is the spacetime concrete?

Adopting spacetime as the substance—as Schaffer does—also allows us to deal with Lowe's charge that the resulting cosmos (spacetime) is not concrete. Again, Lowe is quite right that Schaffer's own definition of concreteness is circular. But Lowe (1998: 51) himself provides a definition of when an object is to be classed as concrete.

> An obvious suggestion is that concrete objects are, while abstract objects are not, denizens of space-time

Lowe does not offer an analysis of what it is to be a 'denizen'. However, a reasonable interpretation of the term as it appears in Lowe's prose is that it means

something akin to the claim that, 'x is concrete if and only if x is located at a region of spacetime'.

This is born out by later discussion by Lowe. Lowe (1998: 210) remarks of his earlier discussion (just cited) of the distinction between the abstract and the concrete:

> 'the distinction between *abstract* and *concrete* entities … was formulated in spatiotemporal terms, with abstract entities being characterized as existing in neither space nor time and consequently lacking spatiotemporal properties and relations.')

Thus, abstract objects are not located at points in space–time and lack spatio-temporal properties and relations; concrete objects are located at points in spacetime and have spatio-temporal properties and stand in spatio-temporal relations.

By this criteria, I claim, the cosmos is concrete. Each part of the cosmos is located at itself. 'Being located at…' is a spatio-temporal relation: no object can be 'located at' anything at all unless there are spatio-temporal relations of some stripe. Now, the putative cosmos under consideration is a maximal sum of concrete objects (since concrete objects are to be identified with regions of spacetime). If all parts of the cosmos have spatio-temporal locations, then the cosmos has spatio-temporal location.[1] Thus, the cosmos (the spacetime) is concrete. Since we have also established that, by Lowe's lights, the cosmos is an object, it follows that (again, by Lowe's own lights) the cosmos is a concrete object.

We have now established that the cosmos is a spacetime and that we have some reason to think that it exists. We have also established that, by Lowe's lights, the cosmos is both concrete and an object. We have dealt with Lowe's first tranche of criticisms.

3 Aggregates and dependence

The next of Lowe's concerns is with Schaffer's claim that we can speak of the cosmos as being fundamental. To make sense of this concern, it will help us to have to hand three of the different kinds of ontological dependence that Lowe (2010) recognises.

> (Rigid Existential Dependence) x depends for its existence upon $y =_{df}$ Necessarily, x exists only if y exists.

As Lowe (2010) explains, this is equivalent to: 'Necessarily, if x exists, then y exists'; the (rigid) 'existential dependence of x upon y amounts to the *strict implication* of y's existence by x's existence'. It's easy enough to give an example; Lowe's own, will serve. It is true that, necessarily, if Caesar's assassination exists,

[1] I assume that the having of location is transitive, such that if x and y are all of the parts of z, and x and y both have spatio-temporal locations, then z has a spatio-temporal location.

then Caesar exists. As a consequence, we may say that Caesar's assassination rigidly existentially depends upon Caesar's existence. So far, so good.
Let us now add Lowe's (2010) notion of identity dependence:

> (Identity Dependence) x depends for its identity upon $y =_{df}$ There is a function f such that it is part of the essence of x that x is $f(y)$
>
> > For example: because the identity of a marriage depends on the identities of the two people being married, if x is a marriage and y and z are the two people in question, (P5) is satisfied in respect of x and y in virtue of the fact that x is necessarily identical with *the marriage of y with z*—so that in this case the required function is the *marriage with z* function from persons to events.

Lastly, let us add Lowe's (2010) notion of generic existential dependence:

> (EDG) x depends$_G$ for its existence upon Fs $=_{df}$ Necessarily, x exists only if some F exists.

Example: a concrete object will generically depend upon its parts for its existence, as it can survive the loss of its parts, but cannot survive the loss of all parts *simpliciter*.

Last, we should note that, for Schaffer, ontological dependence is a relation that can (and does) relate concrete objects to other concrete objects; it is asymmetric, and is primitive and amenable to no further analysis.

With that in hand, let us to turn to Lowe's concern with Monism regarding aggregates, sums and dependence:

> As I've already indicated, I take the view, which is not uncommon, that a mereological sum of certain items, the *x*s, is *ontologically posterior* to those items. And I can now say more precisely why I believe this is: it is because I believe that a mereological sum is not only rigidly existentially dependent upon the items of which it is a sum—its 'summands'—but is also *identity* dependent on them. Accordingly, it exists *in virtue of* them, not vice versa (2012: 95)

A nice example—again, it is Lowe's—is that of a heap of rocks. Intuitively, this is a sum—an aggregate. But in this case, and in most other cases involving aggregates, it seems that we naturally suppose that it is the sum—the heap—that depends for its existence upon the individual rocks, and not the other way around. Of course, the cosmos is a mereological sum. And as we have just seen, it seems that mereologial sums are existentially dependent upon their *summands*. Thus, according to Lowe, the cosmos is, contra Schaffer, rigidly existentially and identity dependent upon its summands—its parts.

3.1 Spacetimes and dependencies

The trouble that I think faces Lowe, here, is that this cosmos—this spacetime—is not *just* a sum. Indeed, this seems to be a case where (intuitively) the material

objects *do* depend upon the whole. The spacetime manifold, it seems, is an entity, and is prior to its parts.

Here are two passages from Schaffer where he describes some of the properties of the spacetime manifold.

> Manifold structure is in part topological structure, and topological structure, it is easy to see, is irreducibly global. Consider a two-dimensional Euclidean plane (and the surface of) an infinite cylinder. They are locally indistinguishable: each consists of continuum-many points that are locally Euclidean. But the plane and the cylinder differ topologically. For example, the plane, but not the cylinder, is simply connected: all closed paths can be continually contracted to a point [Bricker 1993: 288).

> To be a part of spacetime is to have such topological and geometrical features, and parts of spacetime have these constitutive features in virtue of their embedding in the whole. The parts thus depend for their natures on the whole. (2009: 136)

And,

> at least on metric essentialist and moderate structural realist views—the parts of spacetime are individuated by their place in the whole. As Newton himself maintained:
>
> > [I]f yesterday could change places with today… [yesterday] would lose its individuality and would no longer be yesterday, but today; [likewise] the parts of space are individuated by their positions, so that if any two could change their positions, they would change their individuality at the same time and each would be converted numerically into the other. The parts of duration and space are understood to be the same as they really are only because of their mutual order and position;… [Newton 2004: 25)
>
> Thus the parts of spacetime exist as individuals in virtue of their position within the whole. The parts thus depend for their identities on the whole. (Schaffer 2009: 136)

These two quotations seem to reveal two things, both of which are highlighted in the last part of the quotation from Schaffer.

It is not *merely* that the parts depend for their existence upon the whole. For although it *does* seem to be true that the parts depend for their existence upon the whole, it *is also the case that* the parts depend for their identities upon the whole. At least for the time being, we need simply take of the idea that the parts—the summands—do seem to depend for their existence upon the whole—the sum. The more nuanced claims, concerning the different kinds of dependence just adverted to, are ones that I will return to in Sect. 4.2.

So here is the structure of the reply to Lowe. For many sums, it might well be true that, intuitively, sums depend for their existence upon their summands. But most sums are unlike the spacetime manifold, lacking, as they do, its metrical and topological properties. And when we consider a spacetime—with its metrical and

topological properties—it is intuitively clear that this is an entity whose parts depend upon the whole.[2] Thus, contra Lowe, we do have good reasons to think that parts of spacetime depend for their existence upon the whole of spacetime. Since material objects *are* regions of spacetime (cf. Sect. 2.1), so they can be said to depend upon the whole.

3.2 Dialectical concerns

Of course, it's easy enough to imagine a reply. I have argued as follows:

(1) If regions of spacetime are material objects, then material objects depend for their existence upon the cosmos
(2) Regions of spacetime are material objects

Therefore,

(3) Material objects depend for their existence upon the cosmos

Lowe might reasonably replace (2) with

(2)* It's not the case that material objects depend for their existence upon the cosmos

He would thus generate the conclusion that regions of spacetime are not material objects. Aside from foot-stamping, can we say anything more constructive? I think that we can.

The crucial point to note is that whether or not it is intuitive to say that 'x depends upon y' depends, not only upon the natures of x and y, but also how we describe them. The claim that instances of modal predication (and claims of dependence *are* modal) are sensitive to the descriptions of objects that we give is familiar. It seems right to say that Elizabeth's marriage to Sally depends for its existence upon the existence of both Elizabeth and Sally. Elizabeth's marriage to Sally is *itself* a relationship between two people. But it would be implausible to say that 'a relationship between two people depends for its existence upon the existence of Elizabeth and the existence of Sally'. After all, 'a relationship between two people' can exist quite independently of whether either Elizabeth or Sally exist.

So, I suggest, the way to diagnose Lowe's error is as follows. If we describe and understand the cosmos as an aggregate of material objects, then (for the reasons that Lowe gives) it seems wrong to say that the cosmos depends for its existence upon its parts. In contrast, though, if we say that the cosmos is a spacetime, and that material objects are parts of that spacetime, then it sounds entirely natural to say that the cosmos depends for its existence upon its parts. Context is all. Of course, since the theory is Schaffer's, to play the game on his terms—and to challenge his monism—we would have to say that it *does not* seem right to say that the cosmos is a spacetime, and that material objects are parts of that spacetime, and that the cosmos

[2] Of course, many sums *are* prior to their parts. A person, for instance, is a sum, even if (cf. Lowe 1998: 154) a person is taken to be a primitive substance that is not dependent upon its parts.

depends for its existence upon its parts. But since we have just said that it *does* seem right to say that the parts of the spacetime depend upon the whole, this route doesn't seem open to us.

4 Ontological dependence

If we are to say that the cosmos is the single concrete object that all other concrete objects are ontologically dependent upon, then we had better have some grasp of what is meant by the term 'ontological dependence'. What Schaffer does have to say about the prospects for offering an analysis of this relation is a little sparse, and not terribly optimistic.

> Perhaps the notion of priority is amenable to further analysis… I am doubtful but will remain neutral on that question here. (2010: 36)

The first complaint that Lowe then raises (2012: 94), is that, there are many different kinds of ontological dependence (as we saw in Sect. 3). So, Schaffer must say more; he must say something about the *nature* of the ontological dependence in question. With the Lowean options identified, we cannot simply *insist* that there is *some* further notion of ontological dependence that's unanalysed (though Lowe does not, in fact, say why—and it's not entirely clear to me that one must follow Lowe on this score).

The second (though connected) complaint that Lowe raises is that none of the types of ontological dependence that Lowe himself identifies (and that are discussed in Sect. 3) are suitable for playing the role that Schaffer would give to it. To fully appreciate Lowe's point, it's worth spending a moment working through the concern.

Schaffer's notion of dependence cannot be identity dependence: as Schaffer makes clear, the ontological dependence that he has in mind is supposed to lead to *some form* of existential dependence. The parts of the cosmos are supposed to *exist in virtue of it*. Thus, mere identity dependence does not do enough; identity independence does not give rise to such an 'exists in virtue of' relation. All that identity dependence provides us with is something upon which the *identity* of a thing depends. To speak a little loosely: we require *existence in virtue of*, not merely *identity in virtue of*.

Schaffer's notion of ontological dependence cannot be rigid existential dependence. As Lowe explains, rigid-existential dependence is not asymmetric: it is anti-symmetric. And the anti-symmetry would be a problem. It is important for Schaffer, the kind of ontological dependence that we're after is asymmetric. As Schaffer (2010: 37, fn 11) puts it in a footnote:

> Lowe … connects the asymmetry of priority to the general asymmetry of explanation: "'because' *is* asymmetrical, because it expresses an *explanatory* relationship and explanation is asymmetrical," to which he adds: "The asymmetry of explanation is, of course, intimately related to the unacceptability of *circular arguments*."

An anti-symmetric relation will not yield an asymmetry (as is obvious). But if what we're after is explanation (and explanation is taken to be asymmetric), then it will not do to identify an asymmetric relation (like Schaffer's ontological dependence) with the anti-symmetric rigid existential dependence.

Lastly, Schaffer's notion of ontological dependence cannot be generic existential dependence. To see this, note that one of Schaffer's chief examples with which he illustrates his account of ontological dependence is that of a singleton set's dependence upon its member. But, again, note that this relation is supposed to be asymmetric. That is, it is not supposed to be the case that any entity depends for its existence (in Schaffer's terms) upon its singleton set. However, it *is* true that Socrates exists only if {Socrates} exists (since Socrates and {Socrates} are necessarily co-existent). Thus, it *is* true that Socrates is generically existentially dependent upon {Socrates}. This is the wrong result if the notion that we are after an asymmetric account of ontological dependence.

Nonetheless, there is a solution available. It trades upon the moves made in the last section, to identify the cosmos with a spacetime. We will also need to understand how it is that *Lowe* thinks that we should unpack the claim that {Socrates} depends upon Socrates.

4.1 Lowe, Socrates and {Socrates}

For Lowe, the dependence of {Socrates} upon Socrates involves two steps. Note, first, that Lowe *must* say that {Socrates} rigidly existentially depends upon Socrates, for it's metaphysically necessary that if Socrates exists, then so too does {Socrates}. To then *block* the claim that rigid asymmetric dependence is merely anti-symmetric where the relation that we are after is *asymmetric,* Lowe (2012: 95) must add to this that {Socrates} is also *identity dependent* upon Socrates; that is, {Socrates} depends for its *identity* upon Socrates. This pair of relations (rigid existential dependence and identity dependence) gives rise to a relationship between {Socrates}and Socrates that is asymmetric.
Lowe (2012: 95) himself emphasises the significance of this point.

> I am happy to invoke the notion of *identity* dependence to account for the asymmetric between singleton Socrates, {Socrates}, and that unit's sole member, Socrates: the singleton, unlike any other set (apart from the empty set), depends for its identity on its member(s), whereas Socrates does not depend for his identity on the singleton, or any other set, of which he is a member. *That's* why we can say that {Socrates} exists 'in virtue of' Socrates and not vice versa. But just saying the latter, without such an explanation, is not illuminating.

It would—all things considered—be better to offer some illumination.

4.2 Return to the cosmos

I think that, contra Lowe, the result given in the short Sect. 4.1, can now be ported across to Schaffer's metaphysic, provided, as we did in Sect. 3.1, we allow that two intuitive dependencies appear to hold between spacetimes and their parts. It bears to repeat these here.

First, we agreed that the parts of spacetime depend for their *identities* upon the whole (cf. Schaffer 2009: 136). To borrow once again from the passage of Newton (2004: 25) that Schaffer cites approvingly: 'The parts of duration and space are understood to be the same as they really are only because of their mutual order and position'.

Second, though following on, we should note that the parts of spacetime depend for their *existence* upon the whole, and, since the parts of the space–time depend for their *identities* upon the whole, it follows that the existential dependence in question cannot be merely generic; rather, it must be rigid—for had that *very space–time* not existed, then that *particular time* would not have existed (the particular time in question would not have had that very identity had that spacetime not existed). That being the case, what we have here is rigid existential dependence and identity dependence offerings part upon whole. Contra both Schaffer and Lowe, then, we can give an analysis of Schaffer's notion of ontological dependence; it is a relation that parts of a space–time stand into the space–time itself. And since the space–time is the cosmos, and concrete objects are nothing more than parts of the spacetime, this is just to say that concrete objects are ontologically dependent upon the cosmos.

5 Overlap

The last of Lowe's challenges that I want to consider concerns overlap. Schaffer's principle 'no overlap' can be stated as follows.

> No Overlap: $(\forall x)(\forall y)\ ((Bx\ \&\ By\ \&\ x = y) \supset \sim (\exists z)\ (Pzx\ \&\ Pzy))$ (Schaffer 2010: 39)

In words: The requirement that the basics do not overlap is the requirement that no two basic entities have a common part' (2010: 39)

Lowe then raises an objection. He begins by flagging the following from Schaffer (2010: 40): 'the fundamental actual concrete objects should be freely recombinable, serving as independent units of being (building blocks, as it were)'. He then notes a worry for Schaffer.

> This claim, however, threatens to be in tension with some indisputable truths of fundamental particle physics, which tell us that such particles are *not* 'freely recombinable'. Only certain restricted combinations of elementary particles, such as electrons and quarks, can exist in nature, not just *any* combination. (Lowe 2012: 96)

So far as I can tell, there is a straightforward reply to Lowe's concern.

Schaffer is not concerned with *physical* priority. Rather, as he makes clear (2010: 37) he is concerned with *metaphysical* priority, and *metaphysical* foundationalism. There is, then, no reason to think that 'No Overlap' must apply to *physically* basic entities.

Indeed, there is every reason to think that it must not. Schaffer claims that his Monism is metaphysically necessary. Suppose that this is true. It would seem *possible* for the world to be other than it is. Specifically, there would seem to be nothing contradictory about the claim that there are other possible worlds—distinct from, and very different to, the actual world—at which the laws of physics are much as they were described by early proponents of atomism: the physically basic objects are small 'sphere's, causation is affected by 'bangings' of these small spheres, and the laws that govern them are fully deterministic.

Indeed, although they reject this description of the actual world, Ladyman and Ross (2007: 5) give a colourful description of such a scenario:

> The metaphysics of domestication tends to consist of attempts to render pieces of contemporary science—and, at least as often, simplified, mythical interpretations of contemporary science—into terms that can be made sense of by reference to the containment metaphor. That is, it seeks to account for the world as 'made of' myriad 'little things' in roughly the way that (some) walls are made of bricks. Unlike bricks in walls, however, the little things are often in motion. Their causal powers are usually understood as manifest in the effects they have on each other when they collide. Thus the causal structure of the world is decomposed by domesticating metaphysics into reverberating networks of what we will call 'microbangings'—the types of ultimate causal relations that prevail amongst the basic types of little things, whatever exactly those turn out to be. Metaphysicians, especially recently, are heavily preoccupied with the search for 'genuine causal oomph', particularly in relation to what they perceive to be the competition between different levels of reality.

We can surely agree with Ladyman and Ross that the actual world is not made up of these 'basic types of little things' and that this picture is radically naive, given our current best physics.

Nonetheless, there is no reason to think that such a world is incompatible with Monism—just so long as that world is a spacetime, all of the material objects (spheres) at that world are regions of spacetime, and the regions depend for their existence upon the spacetime, there is no problem. Nor is there any reason to think that such a world is impossible. It is simply very different to our own. But, at such a world, what would presumably be *physically* fundamental—where, to be 'physically fundamental' is to play the most basic explanatory role in the physics at that world—would be some combination of these micro-spheres—these 'basic types of little things'.

Thus, it is perfectly plausible to suppose that, for some x, x is physically basic and not metaphysically basic (and vice versa). There is, therefore, no a priori argument here against particular views in physics.

(There are alternative ways of cashing-out this distinction between metaphysical and physical fundamentality. For instance, Ladyman and Ross (2007: 55) prefer to talk of 'physical fundamentality' in terms of 'that part of physics about which measurements taken anywhere in the universe carry information'. They simultaneously reject the notion of metaphysical fundamentality. We need not go that far, of course, but seeing physical fundamentality in the way that they describe, and metaphysical fundamentality in the way that Lowe describes it, would allow us to distinguish physical fundamentality from metaphysical fundamentality. I concede that there may also be other reasons to reject the notion of metaphysical fundamentality—e.g. Tallant (2013))

6 Prospects

To this point, the focus of the paper has been showing that Schaffer's (2010) view can be defended from Lowe's attacks by making recourse to some of Lowe's own theoretical resources in conjunction with some of the remarks made in Schaffer (2009). Well and good. But this union is now something of a new view; a hybrid view. What are the prospects for this hybrid view?

I will make four brief remarks about it. The first two remarks are defensive and are responses to concerns.[3] The final two are more positive and suggest that the hybrid has particular benefits not had by Schaffer's original view.

6.1 The first worry: the spacetime object

Do we really have reason to think that the cosmos is a spacetime? Do we have reason to think that the cosmos is an object? Imagine an objector (perhaps not Lowe) who granted that the cosmos is a spacetime and is studied by physics, but who nevertheless rejects mereological universalism and goes on to claim that spacetime is not an object (and there is no associated mereological sum). This objector treats spacetime as a plurality of points arranged in a certain way. What can be said?

There are, I think, two reasons we might give for thinking that the spacetime really is an entity, and not *merely* a plurality of points; I borrow both from Schaffer. First, let me again borrow from Schaffer, as I did in Sect. 3.1:

> To be a part of spacetime is to have such topological and geometrical features, and parts of spacetime have these constitutive features in virtue of their embedding in the whole. The parts thus depend for their natures on the whole. (2009: 136)

[3] Concerns raised by an anonymous referee—for which, my thanks.

If having specific topological and geometrical features is a product of being a part of a spacetime, then that gives us some reason to think that the spacetime *is* an entity (because the parts of the spacetime have their features in virtue of being parts of *it*). It is (at least prima facie) hard to see how to make sense of the claim that a spacetime region might have the features that it does in virtue of being embedded within a plurality of other regions. It is the overarching nature of the spacetime structure that permits the explanation here, so far as I can tell.

Second, let me borrow (in compressed form) from Schaffer (2010). According to commonsense, integrated wholes are prior to their parts (2010: 49). Commonsense recognizes that there are many different ways in which we could carve up the structure of the world and, given considerations of seeming indeterminacy at the boundaries of concrete objects (2010: 49–50), and the interconnected nature of entangled particles (2010: Sect. 2.2), commonsense recognizes that the world is an integrated whole. Thus, commonsense recognizes that the world is prior to its parts. This, of course, requires that there is a world such that it can indeed have parts, and have those parts be posterior to it. In spelling out these points there is no need to mention, or trade upon, unrestricted mereological composition.

Thus, even if we formally deny unrestricted composition, it may still seem that we have some reasons (delivered by geometry and topology, and intuition) to think that there is such an entity as a spacetime.

6.2 The second worry: sums and identity

Spacetime seems to be a sum, and so have the identity conditions of a sum, which are given in terms of the summands. This is suggested by some remarks I made earlier, perhaps. Certainly, this is how Lowe would have us treat sums; they are dependent upon their summands. But spacetime *also* seems to be an entity in which the parts are identity dependent on the whole (I am endorsing this claim of Schaffer's). So it seems like we have a conflict. What should be said?

There is, in fact, no problem here. As noted, above, Lowe recognizes two distinct kinds of case: cases where entities are prior to their parts; cases where parts are prior to the entities they compose (see Sect. 3.1, esp. fn 2). These two cases will track the difference between *mere* sum, and an entity that is a sum but that is *also* (intuitively) something else; namely, an entity that is prior to its parts.

For Lowe, what we must do is consider the alleged nature of the whole and its parts and then try to work out, intuitively, how to describe the nature of the dependence between them, using some of the various notions of dependence that we have available to us, including rigid existential dependence, generic existential dependence, and identity dependence. This, of course, is the project upon which I've been engaged in Sect. 4.2. I've argued that the dependence that connects the world to its parts is a union of rigid existential dependence and identity dependence. Thus, the cosmos—the spacetime—is not a *mere* sum. The one substance is an integrated whole that is, intuitively, prior to its parts.

6.3 The first hope: A reply to Paul?

Paul (2012) raises an objection to views that, like Schaffer's, seek to treat the spatio-temporal world as the fundamental. As she notes, on different interpretations of our best physics, the spatio-temporal world—the spacetime itself—may end up being emergent from and ontological dependent upon a non-spatio-temporal configuration space, or some other non-spatio-temporal structure. As Paul explains, it seems at least open given our current physical theories that the space–time world is 'just a kind of phenomenal shadow that arises from the real world, the configuration space world' (2012: 234).

Elsewhere, though in a similar vein, Wallace (2012: 42) describes one of the options, thus:

> in quantum gravity, it has long been quite routine to suppose that spacetime (of however many dimensions) is not fundamental at all, but is emergent from some fundamentally non-spatiotemporal entity—spin foam, for instance.

These accounts from our best physics threaten Monism. They appear to suggest that what is fundamental is not, in fact, a spacetime. So much the worse for Schaffer's view.

However, by adopting the proposed hybrid view we may have the means to sidestep this concern, though I concede that this will likely prove tendentious and controversial. According to the hybrid view, spacetime is the most fundamental *concrete object*, where we regard as concrete objects those objects that have spatio-temporal location, spatio-temporal properties, and stand in spatio-temporal relations (cf. Sect. 2.4).

So, let us suppose, as remarks from Paul and Wallace suggest, that our most fundamental physics is concerned with entities and structures that are not spatio-temporal. By the criteria just given, such objects are not concrete (a non-spatiotemproal entity will not have spatio-temporal location, spatio-temporal properties, and stand in spatio-temporal relations). In that case, *that* spacetime is ontologically dependent upon non-spatio-temporal structures is neither here nor there. Such structures are not concrete and so that they might be fundamental is of no threat to the claim that spacetime is the most fundamental *concrete* object and, as such, does not depend for its existence on any *concrete* object.

6.4 The second hope: a reply to Daly?

There are those, like Daly (2012), who profess dissatisfaction with the notions of grounding and ontological dependence. At least a part of the dissatisfaction that they report stems from the fact that, in a number of cases, the notions are left unanalyzed—as they are, of course, in the original position taken by Schaffer. These critics worry, then, that the notions of grounding and ontological dependence are not intelligible.

What clarificatory remarks we do get, they complain, merely serve to spell-out the circular and inter-defined nature of terms like 'grounding', 'fundamental' and

'dependence'. Acting as our representative of such critics, here is Daly (2012: 91–92)

> 'grounding' is supposed to have links to 'fundamentality' and to 'degrees of reality'. An entity is fundamental if and only if it terminates a grounding chain (Schaffer 2009b, 375)…Since the above definition defines fundamental' in terms of 'grounding' any understanding that we have of 'fundamental' has to be given to us through understanding 'grounding'. What we wanted, however, was to gain an understanding of 'grounding'.

So be it.

But by borrowing from Lowe, what I hope to have provided here is a means of understanding ontological dependence in terms of three other notions (rigid existential dependence, generic existential dependence, and identity dependence), each of which were themselves then further spelled out without reference to the others. Although this may not be enough to convince the stubborn sceptic that there is an intelligible notion of ontological dependence that is at the core of the hybrid view that I've outlined, we have at least done *something* to shed light on the central notion of dependence as it appears in the view. To that extent, then, the hybrid view defended here is at least a moderate improvement over that provided by Schaffer himself.

7 Conclusion

It may well be the case that there are reasons to give up on Monism. But the general concerns that Lowe raises about concrete-object-hood, priority and overlap simply do not stick, provided we interpret Schaffer's Monism as a thesis about spacetime. Contra Schaffer, it's also easy enough to make sense of the resulting view, deploying Lowe-style analyses of ontological dependence. I recommend, then, that Monists adopt the spacetime reading of Monism, and that we understand ontological dependence as Lowe would have us.

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