

## BALASHOV ON SPECIAL RELATIVITY, COEXISTENCE, AND TEMPORAL PARTS

Cody S. Gilmore  
University of Nebraska at Omaha  
cgilmore@mail.unomaha.edu

**Abstract:** Yuri Balashov has argued that endurantism is untenable in the context of Minkowski spacetime. Balashov's argument runs through two main theses concerning the relation of coexistence, or temporal co-location. (1) Coexistence must turn out to be an *absolute* or *objective* matter; and in Minkowski spacetime coexistence must be grounded in the relation of spacelike separation. (2) If endurantism is true, then (1) leads to absurd conclusions; but if perdurantism is true, then (1) is harmless. I object to both theses. Against (1), I argue that coexistence is better construed as being *relative* to a hyperplane of simultaneity. Against (2), I argue that the consequences of (1) given endurantism are no worse than the consequences of (1) given perdurantism.

### 1. Introduction

Endurantism (or three-dimensionalism) is the view that material objects are temporally unextended 'continuants' that persist through time by being *wholly present* at each moment of their careers.

The opposing view, perdurantism (or four-dimensionalism), states that persisting material objects are temporally extended 'space-time worms' composed of different *temporal parts* existing at different times.

A number of philosophers have claimed that the special theory of relativity (SR), if true, would render endurantism untenable.<sup>1</sup> Yuri Balashov (2000b, 2000c) has recently proposed an interesting, detailed, and entirely original argument for this claim.<sup>2</sup> Balashov's argument centers around the notion of *coexistence*. Balashov attempts to show that while both endurantists and perdurantists can produce viable accounts of coexistence in the pre-relativistic context of neo-Newtonian spacetime, *only perdurantists* can produce such an account in the relativistic context of Minkowski spacetime.

In this paper I argue that there are at least two (and perhaps three) fatal flaws in Balashov's case for the incompatibility of SR and endurantism. I reconstruct his argument in §2 and criticize it in §§3-5.

## 2. Balashov's Argument

Balashov's argument is conducted under the idealizing assumption that all material objects are spatially unextended, hence that their paths through spacetime can be represented as one-dimensional *worldlines* rather than as four-dimensional *worldtubes*. This assumption allows him to formulate endurantism and perdurantism in spatiotemporal terms, roughly as follows:<sup>3</sup>

Endurantism: For any material object O, each point on O's worldline exactly contains the whole of O. In other words, each material object is *wholly present* at each point on its worldline.

Perdurantism: For any material object O, (i) O is wholly present at exactly one region – namely, O's entire worldline, (ii) each point on O's worldline exactly contains the whole of some material object that is a (spatio-) *temporal part* of O, and (iii) no two points on O's worldline exactly contain the whole of the same temporal part of O.

Henceforth I shall adopt these formulations and the assumption that permits them. I shall also follow Balashov in assuming that SR entails that spacetime is Minkowskian.

Balashov offers his argument for the incompatibility of SR and endurantism as an alternative to the following, older route to the same conclusion.

- P1 SR rules out *presentism*, the view that only present entities exist, and entails *eternalism*, the view that past, present, and future entities are all equally in existence.<sup>4</sup>
- P2 But eternalism rules out endurantism.<sup>5</sup>
- C Therefore SR rules out endurantism.

Like many other philosophers, Balashov accepts P1 and rejects P2. He assumes that SR entails both eternalism and the *tenseless* (or *static* or *B-*) theory of time,<sup>6</sup> but he denies that these consequences of SR force us to abandon endurantism.<sup>7, 8</sup>

Turning now to Balashov's alternative argument, we can reconstruct it in skeletal form as follows:

**Premise 1: Minkowski spacetime, its inhabitants, and their arrangement.** The end of Aristotle's worldline lies within the absolute past of the beginning of Clinton's worldline. However, there is some persisting object, call it Bob, whose worldline contains a point, call it  $p_B$ , that is spacelike separated both from the *final* points on Aristotle's worldline and from the *initial* points on Clinton's worldline. These are facts that both endurantists and perdurantists must accept. (e.g., 2000b: 156, 2000c: S560)

Balashov's goal is to show that the type of situation described in Premise 1 gives rise to absurd consequences *just in case endurantism is true*. (According to Balashov, the situations in question need not involve sentient beings; fundamental particles will do just as well (2000b: 164).) If he achieves this goal, he will have provided Minkowskians with a compelling reason to reject endurantism.

**Premise 2: Coexistence As Spacelike Separation (CASS).** In the context of Minkowski spacetime, the relation of coexistence between material objects must be grounded in the relation of *spacelike separation* between spacetime points. This guiding idea must be accepted by endurantists and perdurantist alike. In the hands of the perdurantist, the guiding idea leads to the following accounts:

- (CP) Perduring object O coexists with (bears CP to) perduring object O\* iff there is a momentary (spatio-) temporal part of O, P, and a momentary temporal part of O\*, P\*, such that the spacetime point occupied by P is spacelike separated from the spacetime point occupied by P\*.<sup>9</sup>
- (CP\*) Momentary temporal part P coexists with (bears CP\* to) momentary temporal part P\* iff the spacetime point occupied by P is spacelike separated from the spacetime point occupied by P\*.<sup>10</sup>
- (Coexistence-P\*) Perduring object O coexists with (coexists-P\* with) momentary temporal part P\* iff there is a momentary temporal part of O, P, such that the spacetime point occupied by P is spacelike separated from the spacetime point occupied by P\*.<sup>11</sup>

In the hands of the endurantist, the guiding idea leads to (CE\*) and (Coexistence\*):

- (CE\*) Enduring object O, wholly present at point  $p$  on its worldline, coexists with (bears CE\* to) enduring object O\*, wholly present at point  $p^*$  on its worldline iff  $p$  is spacelike separated from  $p^*$ .<sup>12</sup>
- (Coexistence\*) Enduring object O, considered in abstraction from any of its locations, coexists\* with enduring object O\* wholly present at point  $p^*$  on O\*'s worldline iff there is some point  $p$  on O's worldline such that  $p^*$  and  $p$  are spacelike separated.<sup>13</sup>

From Premises 1 and 2 it follows that the occupant of point  $p_B$  coexists with both Aristotle and Clinton. (If endurantism is true, then the occupant of  $p_B$  is Bob himself. If perdurantism is true, then the occupant of  $p_B$  is a momentary *temporal part* of Bob. Either way, the occupant of  $p_B$  coexists with both of the two men in question.)

**Premise 3: The Asymmetry Thesis.** Unlike the *perdurantist* who accepts Premises 1 and 2, the *endurantist* who accepts these premises is committed to claims the following form:

STILL The *end* of object  $O_A$ 's worldline lies within the absolute past of the *beginning* of object  $O_C$ 's worldline; hence  $O_A$  and  $O_C$  never coexist with each other. But for object  $O_B$  at point  $p$ , there is a sense in which both  $O_A$  and  $O_C$  are *still* or *already* in existence. (2000b: 155, 2000c: S560-S561)

**Premise 4: The Absurdity Thesis.** All claims of form STILL are absurd. (2000b: 158, 2000c: S561)

**Conclusion.** Endurantists have unacceptable commitments, commitments that can be avoided by rejecting endurantism in favor of perdurantism.

Balashov devotes the bulk of his energy to the task of defending CASS and the Asymmetry Thesis (as I shall call them). Accordingly, these two theses will be the main targets of my criticism. In §4 I focus on the Asymmetry Thesis, and in §5 I focus on CASS. Although Balashov's conclusion could be blocked by rejecting *either* thesis, I conclude that *both* are false. Before turning to these matters, however, I would like to say a few words about the Absurdity Thesis.

### 3. The Absurdity Thesis

Here is a claim of form STILL: Despite the fact that Aristotle and Clinton never coexist with each other, there is a sense in which they are both *still* or *already* in existence for Bob at point  $p_B$ .

According to the Absurdity Thesis, all such claims are absurd or, in Balashov's words, "outrightly contradictory". (2000b: 158) In what way are such claims contradictory? Balashov explains:

A contradiction arises there because the causal and chronological succession of [Aristotle]'s end and [Clinton]'s beginning is in conflict with tensed determinations of being already in existence and being still in existence ascribed, respectively, to [Clinton] and [Aristotle] by an outside enduring observer [i.e., by Bob]. (2000b: 164)

Apparently the idea is this. Suppose that the given claim is true. Then, on the one hand, Aristotle and Clinton never coexist; they are non-contemporaries. Call this the *separateness* claim. But, on the other hand, there is a sense in which they are both still or already in existence *for Bob at point*  $p_B$ . In other words, Aristotle and Clinton are both 'temporally here' for Bob at  $p_B$ . Call this the *togetherness* claim. Evidently Balashov takes the togetherness claim to entail that Aristotle and Clinton *do* coexist, hence to entail that the separateness claim is false. Thus Balashov seems to be presupposing<sup>14</sup>:

- (3.1) If there is a sense in which both  $O_A$  and  $O_C$  are *still* or *already* in existence (if there is a sense in which they are both 'temporally here') for  $O_B$  at point  $p$ , then  $O_A$  and  $O_C$  *coexist*.

If (3.1) is true, then all claims of form STILL are false, and Balashov's Absurdity Thesis stands vindicated. Is (3.1) true?

I concede that this principle has a great deal of plausibility, at least from a naive, intuitive standpoint. It seems to me, however, that (3.1) would *lose* much of its plausibility when considered from the standpoint of someone who accepted CASS. The advocate of CASS holds that coexistence is grounded in spacelike separation, hence that it is possible for a thing (e.g., Bob) to coexist at a single moment of its career with both of two other things (e.g., Aristotle and Clinton) that never coexist with each other. This in itself involves a radical departure from our naive, intuitive ideas about coexistence. But according to Balashov, this is a departure that *we all* must make, regardless of whether we are endurantists or perdurantists.

Once this departure is made, however, there seems to be no compelling reason to retain our allegiance to (3.1). Suppose, for example, that Bob is wholly present at point  $p_B$ . Then, as an

advocate of CASS, he would be forced to say, “Since Aristotle and Clinton both intersect my topological present,<sup>15</sup> they both *coexist* with me.” Having said this, surely he could go on to say, “Since they both coexist with me, there is at least some weak sense in which they are both *still or already in existence* from my perspective. But, contrary to principle (3.1), this last conclusion has no troubling consequences; it is perfectly consistent with the fact that Aristotle’s death lies within the absolute past of Clinton’s birth, hence that Aristotle and Clinton never coexist with each other.”

The point is clear. If I am willing to broaden my ideas about coexistence so as to allow for the possibility that I now coexist with both of two things that never coexist with each other, then I should also be willing to broaden my ideas associated with the phrase ‘are still or already in existence for me’: I should then be willing to broaden these latter ideas so as to allow for the possibility that there is at least some weak sense in which the given phrase can apply to both of two things that never coexist with each other. I submit that anyone who accepts Premises 1 – 3 is free to resist Balashov’s anti-endurantist Conclusion by rejecting Premise 4, the Absurdity Thesis. This matters little, however, since no one should accept Premises 2 or 3.

#### **4. The Asymmetry Thesis**

In this section I address the considerations that Balashov adduces in support of the Asymmetry Thesis. I conclude, first, that Balashov gives us no good reason to accept that thesis and, second, that in the absence of such reasons, we ought to reject the thesis.

The Asymmetry Thesis posits an asymmetry between endurantism and perdurantism. It says: Unlike the *perdurantist* who accepts Premises 1 and 2, the *endurantist* who accepts these premises is committed to claims of the form

STILL	The <i>end</i> of object $O_A$ ’s worldline lies within the absolute past of the <i>beginning</i> of object $O_C$ ’s worldline; hence $O_A$ and $O_C$ never coexist with each other. But for object $O_B$ at point $p$ , there is a sense in which both $O_A$ and $O_C$ are <i>still or already</i> in existence.
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But why should we think that there is such an asymmetry between the two views? Balashov seems to offer two answers to this question. His first answer runs as follows:

If I am an enduring object fully present at a particular [point on my worldline], there is a sense in which some other transient enduring objects exist *no longer* (Sakharov) or *not yet* (Gorbachev's great-grandson) – because they do not bear the relation of Coexistence\* to me-now, whereas yet others are *still* or *already* in existence (Gorbachev) – because they do coexist\* with me-now. . . . [T]he important distinction between things that are (from the point of view of any enduring object at any point of its spatio-temporal career) still or already in existence and those that are not (any longer or yet) has a firm grounding in the invariant structure of Minkowski spacetime.

But why should this distinction be regarded as being all-important to the endurantist? . . . . The answer, briefly, is that *the endurantist must be committed to this distinction in virtue of the basic principle of her ontology, that an enduring object is fully present at any point of its spatio-temporal career (i.e. its worldline)*[my emphasis]. (2000b: 150-151, Balashov's emphasis except where noted)

If I am a perduring object . . . there is *no* sense in which some other perduring objects are 'still' in existence and yet others are 'no longer' (or 'not yet'). . . . If I am a perduring object, I am *never* fully present at any one point of my worldline. At any such point, I am present only partially, and *being only partially present there does not entitle me to certain [temporally-loaded] determinations, as regards the existence of other objects and their coexistence with me, that being fully present does* [my emphasis]. Among my parts, I have the 27 October 1987 one and the 27 October 1997 one. But none of them represents my point of view in a way in which being *fully* present on 27 October 1987 or 27 October 1997 does. (2000b: 153, Balashov's emphasis except where noted)

Balashov's thought here seems to be this. If Bob (e.g.) is not wholly present at point  $p_B$ , then  $p_B$  does not represent Bob's perspective on the universe, and it would therefore be incorrect to say that certain other objects still or already exist *from Bob's perspective at  $p_B$* . If, on the other hand, Bob is wholly present at  $p_B$ , then  $p_B$  *does* represent his perspective on the universe, and it *would* be correct to draw conclusions about what still or already exists for him at  $p_B$ . In particular, we could then conclude that anything that *coexists* with Bob at  $p_B$  is *still or already in existence* for him at  $p_B$ .

More generally:

- (4.1) *For object O at point p, there is a sense in which both object O\* and object O\*\* are still or already in existence iff (i) O is wholly present at p, and (ii) O coexists at p with O\* and O\*\*.*

Balashov can then move from (4.1) to the Asymmetry Thesis via the following line of reasoning.

Suppose that Premises 1 and 2 are true. Suppose also that endurantism is true. Then Bob is *wholly present* at  $p_B$ , and Bob *coexists* at  $p_B$  with both Aristotle and Clinton. Together with (4.1), this commits us to a conclusion of form STILL: Aristotle and Clinton are still or already in existence for Bob at  $p_B$ , and this despite the fact that Aristotle's death lies within the absolute past of

Clinton's birth. Thus it seems that if Premises 1 and 2 are true, endurantists will be committed to claims of form STILL.

Now suppose instead that *perdurantism* is true. Then, as a perduring object, Bob is *not* wholly present at  $p_B$ . Together with (4.1), this entails that it would be *incorrect* to say that Aristotle and Clinton are still or already in existence for Bob at  $p_B$ . Thus it may seem that perdurantists manage to *avoid* a commitment to claims of form STILL, hence that the desired asymmetry between endurantism and perdurantism has been established.

The problem with this line of reasoning is easy to see. Suppose again that Premises 1 and 2, principle (4.1), and perdurantism are all true. Then, although Bob is not wholly present at  $p_B$ , there is a *temporal part* of Bob that *is* wholly present at  $p_B$ . Call this temporal part *Jim*. Since Jim is wholly present at  $p_B$ , and since Jim coexists at  $p_B$  with both Aristotle and Clinton, we are once again committed to a conclusion of form STILL: Aristotle and Clinton are both still or already in existence for Jim at  $p_B$ , and this despite the fact that Aristotle's death lies within the absolute past of Clinton's birth. Therefore, if (4.1) is true, and if Premises 1 and 2 are also true, then perdurantists are committed to claims of form STILL.

The lesson is plain. Far from *supporting* the relevant asymmetry between endurantists and perdurantists, (4.1) would completely *abolish* that asymmetry. I conclude that Balashov's first argument for the Asymmetry Thesis is unsuccessful.

In the passages below, Balashov seems to suggest a *second* argument:

Yet another way to bring out the same point [that was brought out in the passages quoted above] is to note that all the perdurantist principles of coexistence examined in this paper (i.e. CP, CP\*, and Coexistence-P\*) define coexistence as a relation holding between entities that do not change their position in space-time. Consequently, the question of the coexistence of total four-dimensional objects (as in CP), or of their parts (as in CP\*), or of one total object with a part of another (as in Coexistence-P\*) *presupposes* that *all* such entities exist atemporally at their spatio-temporal locations. (2000b: 153)

The coexistence relation governed by CE (and by other endurantist principles considered in this paper) is temporally-loaded . . . because it holds between entities that change their position in space-time and, consequently, coexistence itself becomes a function of time. . . . In the relativistic framework, Newtonian time has to be replaced by *proper time* measured in the rest frame of a particular object. Instead of saying that  $x$  coexists with  $y$  at  $t$ , we say that  $x$ , *when* it is wholly present at some moment of its proper time  $t_x$ , coexists with  $y$ , *when* it is wholly present at  $t_y$ . (2000b: 162)

I have two replies. (1) Like perdurantists, endurantists are free to say both (a) that persisting objects do not *move through spacetime* and (b) that all persisting objects ‘exist atemporally at their spatio-temporal locations’. (But even if endurantists *did* differ from perdurantists with regard to (a) and (b), it is unclear how this fact would support the Asymmetry Thesis.)

First consider (a). Endurantists need not say that persisting objects *move through spacetime*; and in fact they have good reasons not to say this. Change of position in a manifold M is always change of position *in M with respect to* some temporal dimension T, where T is separate from M. Hence there can be no motion through spacetime, since (presumably) there is no temporal dimension separate from the four dimensions of spacetime.

Now consider (b). Like the perdurantist, the endurantist is free to say that all objects ‘exist atemporally at their spatio-temporal locations’. What distinguishes enduring objects from perduring objects is not the ‘manner’ in which they exist at their locations, but the *number* of locations that they have. Each perduring object has exactly *one* complete location, one region that exactly contains the whole of the given object. (The region in question is just the given object’s complete worldline.) Perduring objects, in other words, are *singly* located in spacetime. Enduring objects, on the other hand, are *multiply* located: each of them has *many* complete locations, many regions that exactly contain the whole of the given object. But each of these locations is had *simpliciter* or *atemporally*, not merely *at some moment of the given object’s proper time*. Or so the endurantist is apparently free to say.

(2) I turn now to my second reply to the above passages. One of Balashov’s main points in those passages seems to be this: whereas the endurantist must take facts about coexistence to involve a form of *temporal* or *spatiotemporal modification*, the perdurantist need not. The perdurantist can take all facts about coexistence to have the following form: O coexists *simpliciter* with O\*. The endurantist, on the other hand, should take all facts about coexistence to have one of

the following forms, where ' $p$ ' and ' $p^*$ ' range over times or spacetime points or regions: (i) O coexists at  $p$  with  $O^*$ , or (ii) O, at  $p$ , coexists with  $O^*$ , at  $p^*$ .

Given the complexity of the debates over the semantics and metaphysics of temporal modification, here is not the place to refine or evaluate the foregoing point.<sup>16</sup> Instead, I will simply concede it to Balashov, unrefined: for the endurantist, all coexistence is coexistence *at*; and for the perdurantist, all coexistence is coexistence *simpliciter*.

Initially, this point may seem to lend a certain amount of support to the Asymmetry Thesis. For it entails that, contrary to what I claimed earlier, perdurantists can accept Premises 1 and 2 *and principle (4.1)* without thereby incurring a commitment to claims of the form 'For O at  $p$ ,  $O^*$  and  $O^{**}$  are still or already in existence'. Here is (4.1):

For object O at point  $p$ , there is a sense in which both object  $O^*$  and object  $O^{**}$  are still or already in existence iff (i) O is wholly present at  $p$ , and (ii) O coexists at  $p$  with  $O^*$  and  $O^{**}$ .

Return to the case of Jim the temporal part located at point  $p_B$ . Earlier I said that Jim coexists *at*  $p_B$  with both Aristotle and Clinton. Together with (4.1), this gave rise to a claim of form STILL. In light of the point that I have just conceded to Balashov, however, I can no longer say that Jim coexists *at*  $p_B$  with Aristotle and Clinton; instead, I must say that Jim coexists *simpliciter* with Aristotle and Clinton. But this cannot be combined with (4.1) to yield a claim of form STILL. Thus it may once again seem that the perdurantist has managed to avoid a commitment to the sorts of claims in question, hence that the Asymmetry Thesis has been vindicated.

In letter, perhaps this thesis has been vindicated. Effectively, however, it remains unsupported. To see what I mean by this, consider the following principle:

(4.1\*) For object O (*simpliciter*), there is a sense in which both object  $O^*$  and object  $O^{**}$  are still or already in existence iff (i) O is wholly present at some point, and (ii) O coexists (*simpliciter*) with both  $O^*$  and  $O^{**}$ .

From (4.1\*), together with Premises 1 and 2 and perdurantism, it follows that:

STILL\* Aristotle's death lies within the absolute past of Clinton's birth, hence Aristotle and Clinton never coexist. But for Jim (*simpliciter*), there is a sense in which both Aristotle and Clinton are *still* or *already* in existence.

Any plausibility that attaches to (4.1) should also attach to (4.1\*). If Bob's coexisting *at*  $p_B$  with Aristotle and Clinton forces us to conclude that these two men both still or already exist for Bob *at*  $p_B$ , then Jim's coexisting *simpliciter* with Aristotle and Clinton forces us to conclude that they both still or already exist for Jim *simpliciter*. But if the former conclusion conflicts with the historical fact that Clinton never coexists with Aristotle, then so does the latter. If claims of form STILL are unacceptable, then so are claims like STILL\*.

Thus the outcome of our concession to Balashov is just this. The perdurantist exchanges commitments of one sort for commitments of a second sort, where those of the second sort are no less troubling than those of the first. No relevant asymmetry between endurantism and perdurantism has been established.

In the absence of any reason to accept such an asymmetry, we should reject it. Recall Balashov's way of framing the asymmetry:

If I am an enduring object fully present at a particular [point on my worldline], there is a sense in which some other transient enduring objects . . . are *still* or *already* in existence (Gorbachev) – because they do coexist\* with me-now. (2000b: 150, Balashov's emphasis)

If I am a perduring object . . . there is *no* sense in which some other perduring objects are 'still' [or 'already'] in existence. (2000b: 153, Balashov's emphasis)

This last claim is too strong. It is just an undeniable fact that there is *at least some weak sense* in which George W. Bush is *still* or *already* in existence for me at the current point on my worldline. Insofar as perdurantism can be taken seriously, it must be consistent with such facts. And it *is* consistent with them. I take it that the following definition captures one perfectly legitimate sense of the expression in question:

For object O at point  $p$ , object O\* is still or already in existence  $\equiv_{df}$  O has a temporal part,  $O_p$ , that is wholly present at  $p$ , and  $O_p$  coexists (*simpliciter*) with O\*.

Thus, even if I am a perduring object, there is at least some weak sense in which Bush is still or already in existence for me at the current point on my worldline. Similarly, if Premises 1 and 2 are true, and the occupant of point  $p_B$  coexists with both Aristotle and Clinton, then the following is

undeniable: *even if Bob is a perduring object*, there is at least some weak sense in which both Aristotle and Clinton are still or already in existence for Bob at  $p_B$ . Since the Asymmetry Thesis would force us deny the undeniable, that thesis must be rejected. It follows that the endurantist and the perdurantist are on equal footing with respect to the sorts of problems that Balashov poses for the former. If these problems are fatal for the endurantist, then they are fatal for the perdurantist as well; and if they are non-fatal for the perdurantist, they are non-fatal for the endurantist.

### **5. Coexistence As Spacelike Separation**

If the criticisms made in §4 are correct, then the Asymmetry Thesis is false, and consequently Balashov's argument as a whole is unsound. Even if these criticisms are incorrect, however, Balashov's argument fails anyway, since CASS is false. Or so I intend to show.

Before I make any really substantive objections to CASS, I would like to take note of one relatively minor and easily corrected problem with it. Suppose that two enduring particles collide at a single spacetime point. Presumably they *do* coexist at the place and time of their collision; indeed, the alternative is unintelligible. According to CASS, however, these objects *do not* coexist at the point of their collision, since at that point their separation is *null* (lightlike), not spacelike as (CE\*) requires. A version of this objection applies to (CP). Suppose that I am a perduring object (and am spatially unextended, in accordance with Balashov's assumption). Then surely I coexist with my 'full-grown adult' temporal part, which is itself a perduring object. But according to (CP) I do not so coexist, since no point on the worldline of my full-grown adult temporal part is spacelike separated from any point on my worldline. The underlying problem can be expressed even more simply by noting that, contrary to (CE\*), (CP), and (CP\*), coexistence is *reflexive*: everything coexists with itself (*simpliciter*, or *at a given point*).

The necessary remedy is to find a relation other than spacelike separation to serve as the basis of coexistence. The obvious candidate for this role is the relation of *spacelike-separation-or-identity* between spacetime points. Although our colliding particles are not *spacelike separated* at

the moment of their collision, they do occupy *the very same spacetime point*. As a result, our revised account treats these particles as coexisting, as it should. Similarly for the case of overlapping perduring objects. This revision obviously handles the other counterexamples as well. Henceforth I shall speak as though Balashov had incorporated this revision into his original proposal.

On to larger issues. Balashov insists that any acceptable account of coexistence in a relativistic context must satisfy each of the following adequacy constraints:<sup>17</sup>

*Symmetry*: It must turn out that coexistence is a symmetric relation.

*Objectivity*: It must turn out that “given two objects (or their momentary parts . . .) having particular locations in spacetime, there [is always] a *fact of the matter* about their coexistence.” (2000c: S553)

*Relevance*: It must turn out that the coexistence of any two objects is relevant to their being *temporally co-located* (or ‘co-present’) with one another.

Balashov’s argument for CASS amounts to the following: (1) CASS satisfies each of the foregoing constraints, and (2) CASS is the *best* account of coexistence in a relativistic context that satisfies those constraints.

I concede both (1) and (2). Nevertheless, I reject CASS. I reject it in favor of the following account of coexistence:

REL Coexistence is *relative* to a hyperplane of simultaneity (to a *plane*).<sup>18</sup> For any objects O and O\* and any plane *t*, O and O\* coexist at *t* iff O’s worldline intersects *t* and O\*’s worldline intersects *t*.

I admit that REL is at a disadvantage to CASS in certain respects. All things considered, however, I take REL to be the superior account of coexistence.

Let me begin with REL’s main disadvantage. Unlike CASS, REL violates the Objectivity constraint. Suppose that you are wholly present at the spacetime point  $p_B$ . Do you coexist with Aristotle at the moment of his death? According to CASS, the answer is a definite ‘Yes’, since  $p_B$  is spacelike separated from Aristotle’s death. According to REL, on the other hand, there is no objective or absolute fact of the matter: at some planes of simultaneity you *do* coexist with the

dying Aristotle, and at others you *do not*. So REL is exactly the sort of account that the Objectivity constraint is meant to forbid.

Does this by itself constitute a sufficient reason for rejecting REL? Not unless coexistence has genuine ontological implications. Suppose for example, that I were committed to a two-way link between *what exists* and *what coexists with me*. In that case, the relativity of coexistence would force me to accept the relativity of *existence*. If I occupied some distant part of the universe and as a result it were a relative matter whether or not Aristotle coexisted with me, I would be forced to conclude that it was a relative matter whether or not Aristotle existed. And it *would* be genuinely upsetting, and perhaps outright absurd, to think that *existence* was a relative rather than an objective matter.<sup>19</sup>

This problem disappears when we adopt a tenseless, eternalist conception of time. (Balashov assumes (i) that SR entails such a conception and (ii) that this conception by itself poses no threat to endurantism; see note 8.) Eternalism, recall, is the view that past, present, and future entities are all equally real, all equally in existence. As an eternalist, you must admit that there *exist* many things that do not *coexist* with you. Thus, even if it is relative matter whether Aristotle *coexists* with you, it remains a non-relative, objective fact that Aristotle *exists*. So, given eternalism, the relativity of coexistence encoded in REL does not yield the troubling result that *what there is* is relative. As eternalists, then, we ought to agree that REL's violation of the Objectivity constraint does not by itself constitute a sufficient reason to reject REL.

One point deserves emphasis here. Although the eternalist holds that past, present, and future entities are all equally in existence, she does not hold that all such entities are *still* or *already* in existence. To say that a given object is still or already in existence is to do more than ascribe a robust *ontological status* to the object: in addition, it is to say something about the object's *temporal location*; it is, so to speak, to say that the object is 'temporally here'. Thus, as Balashov notes (at, e.g., 2000b: 163, note 23), the eternalist can say: "All past, present, and future objects are equally in *existence*: they all have the same robust ontological status; they all belong to the domain

of quantification. But there is a *sense* in which some of these objects are *no longer* in existence, some are *still* or *already* in existence, and some are *not yet* in existence: some of them are ‘temporally elsewhere’, and some are ‘temporally here’.” (The foregoing words are mine.)

For the eternalist, then, the situation is this. There is a deep rift between the *ontological* notion of *existence*, on one side, and the *locative* notions of *coexistence*, *temporal ‘here-ness’*, and being *still* or *already* in existence, on the other side. Although genuine ontological relativity would be troubling, the relativity of coexistence does not entail it. And although the relativity of coexistence *would* probably entail the relativity of temporal ‘here-ness’ and the relativity of what is *still* or *already* in existence, these latter two sorts of relativity are not especially troubling. At worst, they are initially counterintuitive.

Having acknowledged one respect in which REL is at a disadvantage to CASS, and having shown that this disadvantage is far from being decisive on its own, I turn to the advantages that REL has over CASS. I can think of four.

*First advantage.* Unlike CASS, REL makes coexistence a *transitive* relation, in the sense that for any objects A, B, and C, and any plane *t*, if A coexists at *t* with B, and B coexists at *t* with C, then A coexists at *t* with C. According to CASS, on the other hand, coexistence is grounded in spacelike separation, and as a result the former inherits the non-transitivity of the latter. Thus, if CASS is true, there is *no* sense in which coexistence is transitive. Balashov admits that CASS is deficient in this respect. (2000b: 140)

*Second advantage.* It seems that REL is just a natural extension of the fact that *simultaneity itself is a relative matter*. It cannot be denied that there is a tight connection between the notion of coexistence and the notion of simultaneity. Indeed, the following principle comes about as close to being a *conceptual truth* concerning coexistence as anything I can imagine:

SIM    Suppose that object O and event *e* are both wholly present at spacetime point *p*, and suppose that object O\* and event *e*\* are both wholly present at spacetime point *p*\*. Then the *coexistence* of O and O\* has the same status as the *simultaneity* of *e* and *e*\*: O and O\* coexist just in case *e* and *e*\* are simultaneous; and the

coexistence of O and O\* is a relative matter just in case the simultaneity of *e* and *e*\* is a relative matter.

In other words, it seems that our treatment of coexistence in a given context ought to run parallel to our treatment of simultaneity in the given context. And in particular, it seems that if simultaneity is best construed as being a relative matter in a given context, then so is coexistence.

In the context of Minkowski spacetime, of course, simultaneity *is* best construed as being a relative matter. Given a particular event *e*, we do *not* say that *e* is absolutely simultaneous with every event in *e*'s topological present. Rather, we say that for any event *e*\* in *e*'s topological present, *e* and *e*\* are simultaneous with respect to *some* reference frames but are *non*-simultaneous with respect to *other* reference frames. Now suppose that objects O and O\* are wholly present at events *e* and *e*\*, respectively. Although the simultaneity of *e* and *e*\* is a relative matter, Balashov would have us say that the *coexistence* of O and O\* is an *objective* matter; he would have us say that O and O\* coexist not merely relative to a reference frame or a hyperplane of simultaneity, but absolutely. According to REL, on the other hand, the coexistence of O and O\*, like the simultaneity of *e* and *e*\*, is a relative matter. Thus, insofar as REL respects the highly plausible principle SIM whereas CASS violates it, we have a powerful reason for preferring REL to CASS.

*Third advantage.* REL is simpler than CASS. As we saw at the beginning of this section, Balashov's original version of CASS, though pure and simple, is vulnerable to decisive counterexamples involving colliding particles, overlapping perduring objects, and the reflexivity of coexistence. To handle these examples, we were forced to adulterate and thereby complicate Balashov's original account. Whereas Balashov originally had the natural, non-disjunctive relation of *spacelike separation* serving as the basis for coexistence, we were forced to use the unnatural, disjunctive relation of *spacelike-separation-or-identity* between spacetime points as the new basis for coexistence. This, it seems to me, makes the *revised* version of CASS more complicated than REL.

*Fourth advantage.* This is an advantage that will be recognized as such by endurantists but not obviously by perdurantists. From a purely formal or structural point of view, REL demands a less radical departure from our ordinary notion of coexistence than does CASS. Our ordinary notion of coexistence is a *temporally modified* notion; it is the notion of coexistence *at a time*. In this sense, the ordinary notion is *triadic*: it is the notion of a relation that holds between two objects at a time. (On temporal modification, see note 16.) The same is true of the notion of coexistence defined by REL. Although it is *spatiotemporally* rather than *temporally* modified, this notion is triadic in just the same way as is the ordinary notion: it is the notion of a relation that holds between two objects at a plane. According to CASS, on the other hand, the endurantist notion of coexistence is *not* triadic in this way; rather, it is *quadradic*: it is the notion of a relation that holds between one object at a point on its worldline, and a second object at a point on *its* worldline. So if you are an endurantist, then, to the extent that you want to minimize revisions in the formal character of your notion of coexistence, you should prefer REL to CASS. (It is unclear that the perdurantist should be moved by this point because it is unclear what he ought to say about the ‘*–adicity*’ of the coexistence relation, either as ordinarily conceived, or as specified by CASS.)

I conclude that REL is superior to CASS as an account of coexistence in Minkowski spacetime. This conclusion is of no use, however, unless it provides us with an independent solution to the problem that Balashov poses for the endurantist. To see that it does provide such a solution, suppose that you are wholly present at the spacetime point  $p_B$ . Then, according to CASS, there is a sense in which you coexist at  $p_B$  with *both* Aristotle *and* Clinton: you are wholly present at  $p_B$ , and both Aristotle and Clinton have worldlines that intersect the topological present of  $p_B$ . This, together with the a highly plausible principle, yields the potentially troubling conclusion that for you at  $p_B$ , there is a sense in which *both* Aristotle *and* Clinton are still or already in existence. The principle in question is:

- (5.1) If there is a sense in which O coexists at  $p$  with *both*  $O^*$  and  $O^{**}$ , then there is a corresponding sense in which *both*  $O^*$  and  $O^{**}$  are still or already in existence for O at  $p$ .

Now suppose that that REL is true. Suppose also (i) that the plane  $t_A$  intersects both  $p_B$  and some point on Aristotle's worldline, and (ii) that the plane  $t_C$  intersects both  $p_B$  and some point on Clinton's worldline. Then there is a sense in which you coexist at  $p_B$  with Aristotle: you and Aristotle coexist at  $t_A$ , and  $t_A$  intersects  $p_B$ . Correspondingly, there is a sense in which Aristotle is still or already in existence for you at  $p_B$ . A parallel line of thought leads to the conclusion that there is a sense in which Clinton is still or already in existence for you at  $p_B$ .

But since there is no single plane at which you coexist with *both* Aristotle *and* Clinton, there is *no* sense in which you coexist at  $p_B$  with *both* Aristotle *and* Clinton. Consequently, we face no pressure whatsoever to conclude that there is *any* sense in which *both* Aristotle *and* Clinton are still or already in existence for you at  $p_B$ .

Instead, the following conclusions become overwhelmingly attractive. There is *one* sense in which Aristotle is still or already in existence for you at  $p_B$ , and there is *another* sense in which Clinton is still or already in existence for you at  $p_B$ . But there is *no* sense in which *both* Clinton *and* Aristotle are still or already in existence for you at  $p_B$ . Thus the endurantist who accepts Premises 1 and 3 need not reject the plausible principle (5.1) in order to avoid a commitment to the sorts of conclusions that Balashov takes to be so troubling. He can avoid such a commitment simply by abandoning CASS in favor of REL. Perhaps the endurantist can count this as an additional reason for preferring the latter to the former.

## **6. Conclusion**

I have attempted to show that there are at least two fatal flaws in Balashov's 'coexistence' argument for the incompatibility of endurantism and special relativity. I have *not* attempted to show that there are fatal flaws in *every* extant argument for this incompatibilist conclusion; still less have I attempted to cast doubt on the conclusion itself. I do, however, take myself to be entitled to

this much: *so far as Balashov's coexistence argument is concerned*, the friend of four-dimensional Minkowski spacetime is free to be a 'three-dimensionalist' about persisting material objects.<sup>20</sup>

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<sup>1</sup> Quine 1960, Smart 1972, Armstrong 1980. For opposition to this claim, see Mellor 1981, Simons 1987, Oderberg 1993, and Rea 1998.

<sup>2</sup> Balashov has proposed two quite different arguments for the conclusion that endurantism is untenable in Minkowski spacetime. The one that I address here focuses on the notion of coexistence. The second (1999 and 2000a) stems from considerations pertaining to spatial extension. For a critical discussion of the second argument, see Sider 2001.

<sup>3</sup> Balashov proposes these formulations implicitly at 2000b: 129-130, 161 and more explicitly at 2000c: S551, S553.

<sup>4</sup> See, e.g., Putnam 1967, Savitt 2000, and Sider 2001.

<sup>5</sup> See, e.g., Carter and Hestevold 1994 and Merricks 1995.

<sup>6</sup> Proponents of the *tensed* (or *dynamic* or *A-*) theory of time typically hold that events instantiate transient, monadic 'A-properties' such as *pastness*, *presentness*, and *futurity*. Proponents of the rival tenseless theory reject A-properties and content themselves with the claim that events stand in unchanging, dyadic relations such as *earlier than* and *later than*.

<sup>7</sup> Those who take endurantism to be compatible with both eternalism and the tenseless theory include Wilson 1955, Mellor 1981 and 1998, Butterfield 1985, Johnston 1987, Haslanger 1989, van Inwagen 1990, Smith 1993, Rea 1998, Lombard 1999, Lewis 1999 (p. 224), and perhaps Parsons 2000 (whose 'enduring objects' are temporally extended but lacking in temporal parts).

<sup>8</sup> Although he sometimes suggests otherwise, Balashov clearly believes that endurantists need not be presentists or tensers of any kind. Here he explicitly rejects the link between endurantism and presentism:

The *denial* of presentism does not . . . entail the four-dimensional ontology of objects. I will not argue here against the link between the denial of presentism and perdurantism . . . but will simply assume that no such link exists and, hence, that *independent* arguments are needed to demonstrate that SR requires perdurantism and undermines endurantism – the arguments I offer. (2000b: 163, Balashov's emphasis)

And in a separate but contemporaneous paper, Balashov explicitly rejects the link between endurantism and the tensed theory:

The belief in the 4D world of events [i.e., in Minkowski spacetime], as here understood, is arguably incompatible with a certain view of time known as 'A-theory of time' or 'dynamic time'. The most radical version of this view is presentism, the idea that only the present exists. It has recently been intimated that the 3D ontology of objects (i.e. endurantism) entails A-theory of time or even presentism and is inconsistent with the opposite, B-theory of time, or "static time" – the time of modern physics. If this is so, sophisticated [B-theoretic, relativistic] endurantism, my principal target in this essay, may be a non-starter.

Although I believe that arguments for the link between endurantism and "dynamic time" are unsound, I do not consider the issue in the present paper. Instead, I assume that there is no link and, hence, the combination of endurantism with realism about 4D Minkowski world of events is [at least *prima facie*] a tenable one. (1999: 461)

<sup>9</sup> Balashov: "Two perduring objects [P1 and P2] coexist iff they have spacelike separated parts:  $CP(P1, P2) \leftrightarrow \exists P1^{O1} \exists P2^{O2} (P1^{O1} \in P1 \ \& \ P2^{O2} \in P2 \ \& \ R(O1, O2))$ ." (2000c: S555)

<sup>10</sup> Balashov: "Two parts of perduring objects coexist iff their locations are spacelike separated:  $CP_1(P1^{O1}, P2^{O2}) \leftrightarrow R(O1, O2)$ ." (2000c: S555) Elsewhere Balashov explains his notation: "Here 'P1<sup>O1</sup>' and 'P2<sup>O2</sup>' denote *momentary spatiotemporal parts* of two perduring objects P1 and P2 located at [spacetime points] O1 and O2 respectively." (S554, my emphasis)

<sup>11</sup> Balashov: "A perduring object P1 coexists-P\* with the O1 part of another perduring object P2 iff P2 has a part located at a point O2 spacelike separated from O1." (2000b: 152)

<sup>12</sup> Balashov: "Two enduring objects [E1 and E2] coexist [stand in relation CE\*] iff their locations [O1 and O2] are spacelike separated [stand in relation R]:  $CE^*(E1^{O1}, E2^{O2}) \leftrightarrow R(O1, O2)$ ." On the notation: "Here 'E1<sup>O1</sup>' and 'E2<sup>O2</sup>' denote enduring objects E1 and E2 located at [spacetime points] O1 and O2 respectively." (2000c: S554)

<sup>13</sup> Balashov: "An enduring object E2 coexists\* with E1 fully present at O1 just in case there is a point O2 such that E2 is fully present at O2 and O2 is spacelike separated from O1." (2000b: 148)

<sup>14</sup> In correspondence, Balashov has denied that his case for the Absurdity Thesis presupposes (3.1). Without this principle, however, the Absurdity Thesis seems entirely unsupported.

<sup>15</sup> The topological present (also known as the ‘absolute elsewhere’) of a spacetime point  $p$  is the region consisting of exactly those points that are spacelike separated from  $p$ .

<sup>16</sup> For the standard options on change and temporal modification, see Mellor 1981, Lewis 1999 (pp. 187-195), Johnston 1987, van Inwagen 1990, and Hinchliff 1996. For some non-standard options, see Mellor 1998, Parsons 2000, and Macbride 2001.

<sup>17</sup> Balashov 2000b: 133 and 2000c: S552-S553.

<sup>18</sup> An alternative, and perhaps equally good, account of coexistence can be obtained by replacing ‘hyperplane of simultaneity’ with ‘Cauchy surface’. Intuitively, a Cauchy surface is a complete spacelike hypersurface extending throughout the spacetime in question. Savitt 2000 defines a Cauchy surface as an achronal set of spacetime points such that “every timelike or lightlike curve without end intersects the surface exactly once” (p. S571). A set  $S$  of spacetime points is *achronal* iff, for each pair  $\langle p, p^* \rangle$  of members of  $S$ ,  $p$  and  $p^*$  are spacelike separated. The Cauchy-version of REL has the same main virtues and vices as the original. A hyperplane of simultaneity is just a Cauchy surface whose constituent points are mutually simultaneous in some inertial reference frame.

<sup>19</sup> Gödel 1949, Yourgrau 1999, but see also Sklar 1981.

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