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RELATIVITY AND PERSISTENCE[†]

Yuri Balashov[‡]

Abstract

The nature of persistence over time has been intensely debated in contemporary metaphysics. The two opposite views are widely known as "endurantism" (or "three-dimensionalism") and "perdurantism" ("four-dimensionalism"). According to the former, objects are extended in three spatial dimensions and persist through time by being wholly present at any moment at which they exist. On the rival account, objects are extended both in space and time and persist by having "temporal parts," no part being present at more than one time.

Relativistic considerations seem highly relevant to this debate. But they have played little role in it so far. This paper seeks to repair that situation. I argue that considerations based on special theory (SR) strongly favor perdurantism over endurantism. My strategy is the following. I take the essential idea of endurantism, that objects are entirely present at single moments of time, and show that it commits one to unacceptable conclusions regarding coexistence, in the context of SR. I propose and discuss two plausible accounts of coexistence for perduring objects, which are free of these defects. Not surprisingly, the relativistic framework proves to be ready-made for the four-dimensional ontology and rather hostile to the endurantist. She can accommodate the notion of coexistence in this framework only at the cost of renouncing central endurantist intuitions.

[†] A longer version of this paper is forthcoming in *Philosophical Studies* and is available on my web page in the .pdf format: http://www.ruf.rice.edu/~yuri/endur.pdf

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[‡] Center for the Study of Science and Technology, MS-147, Rice University, 6100 Main St., Houston, TX 77005-1892. Email: yuri@ruf.rice.edu

1.

Persistence over time has become a hot topic in contemporary metaphysics. Two rival accounts of persistence of material objects through time are currently on the market: *endurantism* (aka *three-dimensionalism*, *3D*) and *perdurantism* (aka *four-dimensionalism*, *4D*, or *the doctrine of temporal parts*).[1] Objects endure if they persist by being *wholly present* at different moments of time. One and the same object can be entirely present at t_1, then it can be entirely present at t_2; when it is at t_2, it is no longer present at t_1, neither is any part of it. On this view, objects are three-dimensional entities that do not have "temporal extension."

Objects are said to perdure if they persist by virtue of having temporal parts, or stages, at different times, no part being fully present at more than one time. On this view, objects are actually four-dimensional: they are extended both in space and time. Persistence is not a matter of strict transtemporal identity, because, in the four-dimensional ontology, nothing can be present at two different times. Instead of literal identity over time, we have to speak of a mereological relation *being a temporal part of the same 4D entity as*.

Relativistic considerations seem highly relevant to the 3D/4D debate. But they have played little role in it so far. In fact the debate largely proceeds as if there were no theory of relativity around. This paper seeks to repair that situation. I argue that relativistic considerations strongly favor perdurantism (that is, 4D) over endurantism (3D). My strategy is the following. I take the essential idea of endurantism, that objects are entirely present at single moments of time, and show that it commits one to unacceptable conclusions regarding *coexistence*, in the context of SR. I propose and discuss two plausible accounts of coexistence for perduring objects, which are free of these defects. The relativistic framework proves, not surprisingly, almost ready-made for the 4D ontology but rather hostile to the endurantist. I conclude that she can accommodate the notion of coexistence in this framework only at the cost of renouncing central endurantist intuitions

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[1] The terms "endurantism" and "perdurantism" are originally due to Mark Johnston and David Lewis. See Lewis 1986, 202, Johnston 1987. On the perdurantism-endurantism debate see, e.g., Armstrong 1980, Haslanger 1989ab, Heller 1990, van Inwagen 1990, Carter and Hestevold 1994, Merricks 1994, 1995. For useful definitions of the notions of 'temporal part' and 'being wholly present at *t*' see, especially, Markosian 1994, Zimmerman 1996.

2.

The notion of coexistence is central to the metaphysics of objects, just as the notion of becoming is central to the metaphysics of events and to the philosophy of time. Whereas becoming is a fundamental relation between or among events, coexistence is an equally fundamental relation between or among objects. Coexistence is to object as becoming is to events.

I take it to be uncontroversial that any reasonable ontology of objects must accommodate the concept of coexistence. This assumption is quite general and neutral with respect to the endurance versus perdurance controversy. The endurantist and the perdurantist would certainly want to construe coexistence (or the lack of it) differently. But no one of them would be willing to deny, on pain of solipsism, that she coexists with various objects—tables and chairs, as well as other persons—and no one would be inclined to admit that, in any interesting sense of coexistence, she coexists with all of them indiscriminately. Whether objects endure or perdure, there must be a sense of the coexistence relation such that I bear this relation to Bill Clinton but not to Napoleon. Both parties to the debate about persistence would agree that coexistence must be a non-trivial relation between objects.

They would, however, disagree on the way in which the notion of time must figure in the concept of coexistence. The endurantist concept of coexistence is tensed or "temporally-loaded" in a way in which the perdurantist one is not. It is tensed, because it holds between entities that change their positions in space-time and, consequently, coexistence itself becomes a function of time. If I am an enduring object, then I coexist with another enduring object always *at a particular time* at which I am wholly present. For example, if I am wholly present today, then I coexist with Clinton wholly present today but not with Clinton wholly present tomorrow.

The perdurantist notion of coexistence is different because it holds between entities that do not change their locations with time. Such entities are either 3D (spatio-)temporal parts of 4D things or four-dimensional wholes "permanently" confined to their spatio-temporal locations. There is no question here of something *coming to coexist* with something else. If I am a perduring

object, I cannot say that I came to coexist with Bill Clinton when I was born, and that this coexistence will cease to take place when one of us dies. This would be appropriate if I were a 3D object that can be wholly present at more than one time. But four-dimensional entities do not really come to be or go out of existence. Each of them just has a particular temporal extension. Whether such entities coexist is a completely tenseless, or atemporal, issue.

The task of the endurantist, therefore, is to provide a tensed, or temporally-loaded (in this special sense), and non-trivial notion of coexistence in the context of SR, and the task of the perdurantist is to provide a tenseless such notion. I argue below that, whereas the perdurantist can easily fulfil her task, the endurantist confronts difficulties in the attempt to do justice both to special relativity and the 3D ontology.

3 .

I'd like to start by making a useful idealization and imposing certain general requirements on the notion of coexistence.

Idealization: From now on we will be dealing with point-like enduring and perduring objects, which do not have spatial extension. This does not detract from the generality of the analysis but makes it much simpler.

Symmetricity: The coexistence relation *C* must be *symmetric*. An account on which *x* coexists with *y*, $C(x, y)$, but *y* does not coexist with *x*, $\sim C(y, x)$, would hardly have anything to do with the notion of coexistence.[2]

Objectivity: Given two objects (or their momentary parts, in case of perdurantism) having particular locations in space-time, there must be a fact of the matter about their coexistence.

Consider two point-like enduring objects E1 and E2 and their world lines representing their spatio-temporal careers in space-time. The endurantist would certainly want to say that, in a wide variety of cases, these objects would coexist. What are necessary conditions of the coexistence of

E1 and E2? Given that enduring objects are wholly present at single points of their histories, they cannot coexist unless they are, in *some* sense, *co-present* to one another. To put it differently, coexistence of enduring objects must be grounded in some relation *R* between their momentary spatio-temporal locations O1 and O2—a relation that would express the fact of their co-presence.

In the classical neo-Newtonian framework, co-presence was entirely unproblematic. E1 and E2 could be said to coexist just in case they both exist *at the same time*, or belong to the same "present." More formally, neo-Newtonian space-time is uniquely decomposable into the set S of hyperplanes of *absolute* simultaneity, $\mathsf{S} = \{ \mathrm{HPS}^{t_{abs}} \}$, where t_{abs} is the absolute Newtonian time. In this pre-relativistic framework, relation *R* could be defined as follows:

$$R^{N}(\mathrm{O1}, \mathrm{O2}) \leftrightarrow (\exists t_{abs})(\mathrm{O1} \in \mathrm{HPS}^{t_{abs}} \ \& \ \mathrm{O2} \in \mathrm{HPS}^{t_{abs}})$$

and the corresponding principle of coexistence for enduring objects would be ('N' standing for "Newtonian"):

(CE^{N}) Two enduring objects coexist iff they are co-present to one another, that is, iff their locations belong to the same $\mathrm{HPS}^{t_{abs}}$: $CE^{N}(\mathrm{E1}^{O1}, \mathrm{E2}^{O2}) \leftrightarrow R^{N}(\mathrm{O1}, \mathrm{O2})$.

Here '$\mathrm{E1}^{O1}$' and '$\mathrm{E2}^{O2}$' denote enduring objects E1 and E2 located at O1 and O2 respectively. The relation of coexistence CE^{N} defined in this way is symmetric because it is grounded in the symmetric relation R^{N}. CE^{N} is also transitive: $CE^{N}(\mathrm{E1}^{O1}, \mathrm{E2}^{O2}) \ \& \ CE^{N}(\mathrm{E2}^{O2}, \mathrm{E3}^{O3}) \rightarrow CE^{N}(\mathrm{E1}^{O1}, \mathrm{E3}^{O3})$. In general, on this pre-relativistic view, every enduring object coexists with any other by virtue of being co-present with it in every reference frame.

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2 Indeed, what would an advocate of such an account *mean* by coexistence? After all, things either do or do not exist. If *x* exists and *y* coexists with it, then *y* exists as well. But *x* also exists, as per the initial assumption, and, hence, coexists with *y*.

Turning now to the perdurantist ontology, one could formulate two distinct principles of coexistence in the classical framework.

(CP_1^N) Two momentary parts of perduring objects coexist iff they are co-present to one another, that is, iff their locations belong to the same $HPS^{t_{abs}}$: CP_1^N ($P1^{O1}$, $P2^{O2}$) $\leftrightarrow R^N$(O1, O2).

Here '$P1^{O1}$' and '$P2^{O2}$' denote momentary parts of two perduring objects P1 and P2 located at O1 and O2 respectively. CP_1^N is symmetric and transitive.

The perdurantist may also be interested in another notion of coexistence applying to entire 4D objects, rather than to their momentary 3D parts:

(CP_2^N) Two perduring objects coexist iff they have co-present momentary parts whose locations belong to the same $HPS^{t_{abs}}$: CP_2^N (P1, P2) $\leftrightarrow \exists P1^{O1} \exists P1^{O2}$ ($P1^{O1} \in$ P1 & $P2^{O2} \in$ P2 & R^N(O1, O2)).

To put it informally, four-dimensional perduring objects related by CP_2^N temporally "overlap."

CP_2^N is symmetric but not transitive. But there is no reason to expect, or require, transitivity of this relation of coexistence. I coexist or "overlap," in the sense of CP_2^N, with my father, and he "overlaps" with my grandfather, but I don't "overlap" with my grandfather, and this is anything but surprising.

These simple accounts of coexistence become inadequate in the relativistic context where there is no place for absolute simultaneity. Two enduring objects, or two momentary parts of perduring objects, may be "co-present" (that is, their spatio-temporal locations may be simultaneous) in one (inertial) reference frame but not in another. To express their coexistence, one can no longer rely on relation R^N holding in *every* reference frame if it holds in *any*. This does not mean that no other relation *R* can be singled out to ground the coexistence of objects (or of their

parts) in an objective and relevant way. In it clear, however, that all such relations must themselves be grounded in the invariant structures of Minkowski space-time.

4.

The most natural candidate for *R* is surely the relation of space-like separation:

$$R\,(O1, O2) \leftrightarrow \eta(O1, O2)<0$$

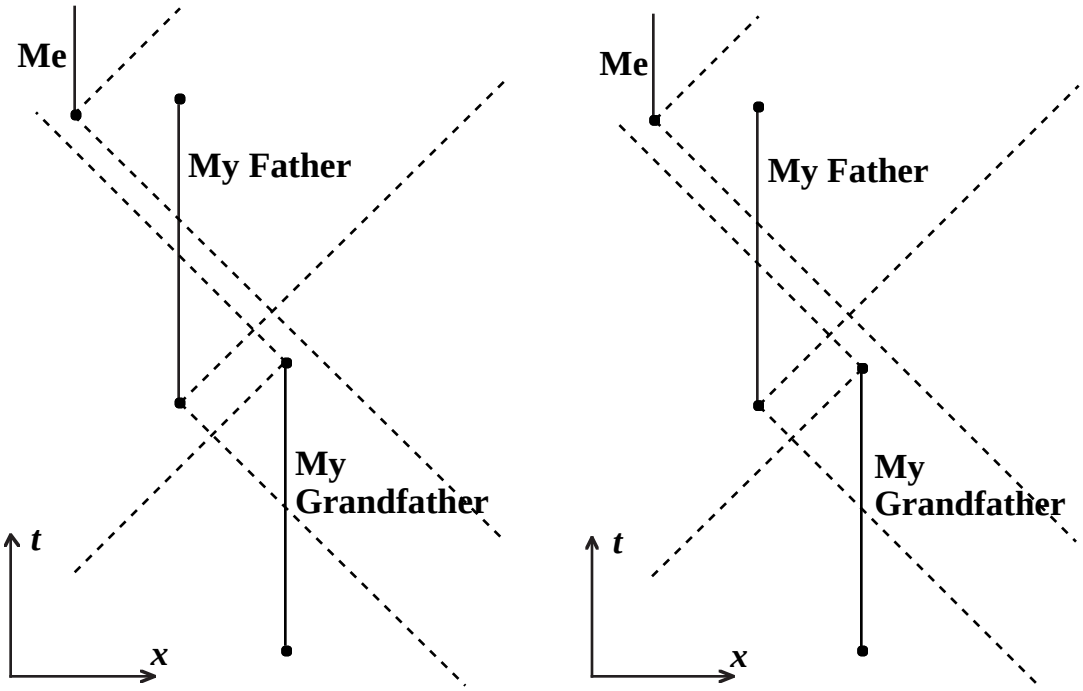
This suggests the following candidate principles of coexistence for enduring and perduring objects (and the latter's parts) in Minkowski space-time:

(CE) Two enduring objects coexist iff their locations are space-like separated: $CE\,(E1^{O1}, E2^{O2}) \leftrightarrow R\,(O1, O2)$.

(CP_1) Two parts of perduring objects coexist iff their locations are space-like separated: $CP_1\,(P1^{O1}, P2^{O2}) \leftrightarrow R\,(O1, O2)$.

(CP_2) Two perduring objects coexist iff they have space-like separated parts: $CP_2\,(P1, P2) \leftrightarrow \exists P1^{O1} \exists P1^{O2}\,(P1^{O1} \in P1 \,\&\, P2^{O2} \in P2 \,\&\, R\,(O1, O2))$.

We now have to investigate whether each of these candidates is acceptable as a principle of coexistence for a corresponding type of entity in the relativistic context. Let us begin with CP_2. Being a relativistic counterpart of CP_2^N, it expresses the idea of "overlap" in a Lorentz-invariant language: instead of a literal temporal overlap, it refers to a relativistic "overlap" of the light cones (Figure 1).



(a) (b)

Fig. 1. Coexistence ("Overlap") of four-dimensional objects (a) in neo-Newtonian space-time; (b) in Minkowski space-time. In both cases, I "overlap" with my father and he "overlaps" with my grandfather. But I do not "overlap" with my grandfather.

The relation of coexistence governed by CP_2 is objective in the sense specified above: given two perduring objects, there is a fact of the matter about their coexistence ("overlap"). CP_2 is obviously symmetric. Just like its classical counterpart, it is not transitive. But this is good news: If CP_2 were transitive, it would hold between any two perduring objects whatsoever and thus be trivial.

CP_1 does not fare equally well in this regard. Whereas relation CP_1^N expressed by its pre-relativistic counterpart is transitive, that expressed by CP_1 is not. But in making a transition to the relativistic context, one has to be prepared—regardless of whether one is an endurantist or a perdurantist—to make some changes in the notion of coexistence. One should not expect this notion to emerge completely intact from the transition at hand.

Another notable difference between CP_1 and its classical predecessor, CP_1^N, is that, on CP_1, a given part of one perduring object coexists, in general, with many parts of another object—in fact, with infinitely many of them—indiscriminately.

Turning now to CE, notice, first, that it also emerges whittled-down from the transition to the relativistic context. Just like its perdurantist analog CP_1, it does not allow to preserve transitivity of the coexistence relation. The important distinction between them, however, lies in their different attitudes to the role of time. As already noted, the notion of coexistence pertinent to the endurantist ontology is tensed, or temporally-loaded, in a way in which the corresponding perdurantist notion is not. These features are preserved in the relativistic context, except that the function of the absolute Newtonian time is now played by the *proper* time associated with the state of motion of individual (inertial) enduring objects, or with the orientation of the (inertial) world lines representing individual perduring objects.

To see this, note, again, that coexistence of enduring objects holds between entities fully present at single moments of their proper times. Therefore, the coexistence relation itself becomes a function of these times. I-now (according my clock) coexist with the 4244-years-old Crab Nebula (according to its clock). But the 4000-years-old Crab Nebula does not coexist with me-now.[3] Consequently, there is a sense in which the Crab Nebula *comes* to coexist with me at a certain point of its life career measured by the proper time elapsed since its birth in the explosion of a famous supernova. It is in this respect that coexistence of enduring objects regulated by CE is a tensed or temporally-loaded notion.

On the contrary, there is no sense in which any momentary part of the four-dimensional Crab Nebula "comes" to coexist with any part of me. There is also no sense in which the whole perduring Crab Nebula ever comes to coexist with any other perduring object in the universe. Four-dimensional objects and their parts do not change their spatio-temporal locations in the way

[3] In fact, it doesn't coexist with me at all, in the sense of CE* introduced below.

three-dimensional enduring objects do. Their coexistence, as regulated by CP_1 and CP_2, is a tenseless, or atemporal, notion.

The difference, as we shall see in a moment, is crucial. It raises serious problems for the endurantist wishing to adhere to 3D ontology in the context of SR. To get a sense of these problems, notice that whereas on CP_1, a given part of one perduring object can coexist, as already mentioned, with many parts of another perduring object, a given enduring object can, on CE, coexist with another enduring object *more than once*. Thus, E2 coexists with E1 located at O1 *both* when E2 is at $O2^{(1)}$ *and* when it is at $O2^{(2)}$ (Figure 2), because both $O2^{(1)}$ and $O2^{(2)}$ are space-like separated from O1.

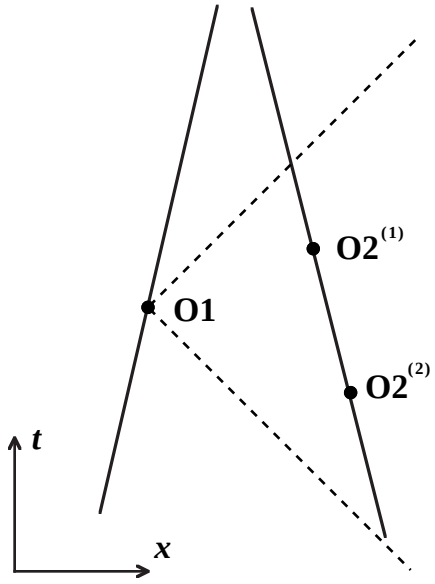


Fig. 2. E1, when it is at O1, coexists with E2, when the latter is at any point in the topological present of O1, in particular, when it is at $O2^{(1)}$ *and* when it is at $O2^{(2)}$.

For example, if I am an enduring object, I must conclude, based on CE, that I coexist, on 24 October 1998, at 10:30 am, according to my clock (CST), with ex-president Gorbachev, when his clock shows 7:30 pm (Moscow time) *and* when it shows 7:30 pm *plus or minus a fraction of a second*. In general, I coexist, on 24 October 1998, at 10:30 am CST, with all enduring objects in

the universe that are fully present at space-time points located outside the future and past light cones of me-now.[4]

This, as I will show in a moment, is troublesome. The trouble comes, in effect, from the "if" part of CE. To respect both the endurantist ontology and special relativity, CE introduces a peculiar combination of tensed and tenseless elements. On the one hand (as already mentioned), the coexistence relation it espouses is not tenseless in the way the relations governed by CP_1 and CP_2 are. On CE, it is imperative, *from the point of view of E1*, to ask *when* it coexists with E2: E1 coexists with E2 always *at a given moment*—for example, *when* E1 is at O1, as in Figure 2. On the other hand, CE seeks to meet the relativistic requirements by denying what CE^N asserts, namely, that coexistence of E1 and E2 hinges on there being a fact of the matter as to *where* (on its world line) E2 is *when* E1 is, say, at O1. E2 may be at any point in the *elsewhere* of O1, that is, outside the past and future light cones of O1. E2, in fact, fully exists at *all* such points *at different times* (as measured by its clock) and at all such times it coexists with E1, when the latter is at O1. The denial that, when E1 is at O1, other enduring objects coexisting with it must be at some particular points on their world lines commits the endurantist to a certain ontological latitude that is potentially damaging in a way the corresponding latitude sanctioned by the perdurantist principle CP_2 is not. A cure, I will argue, can be purchased only at the cost of renouncing some important endurantist intuitions.

5.

Certain enduring things, but no perduring ones, come to be and cease to exist. In-between, they enter into various relations of coexistence with other enduring things. For a given enduring object, the changing relations of coexistence it enters into during its life career provide a changing perspective on the rest of the existence, a dynamic "window" through which such an object "views" the world.

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[4] It should be noted that, although illustrations involving conscious beings are particularly revealing, nothing in my arguments turns on the notion of conscious perception. The principles of existence and coexistence examined in this

To make these ideas precise, let us introduce the notion of Coexistence*[5] based on a straightforward generalization of CE*.

(CE*) 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 space-like separated from O1: CE^* (E2, $E1^{O1}$) $\leftrightarrow \exists E2^{O2} R$ (O1,O2).

Another way to express the idea of Coexistence* is by saying that E2 coexists* with E1 fully present at O1 if and only if the "elsewhere" of O1 includes some part of E2's world line.

To illustrate, Gorbachev, but neither his vigorous critic Sakharov, nor Gorbachev's great-grandson, coexists* with me-now (Figure 3).[6]

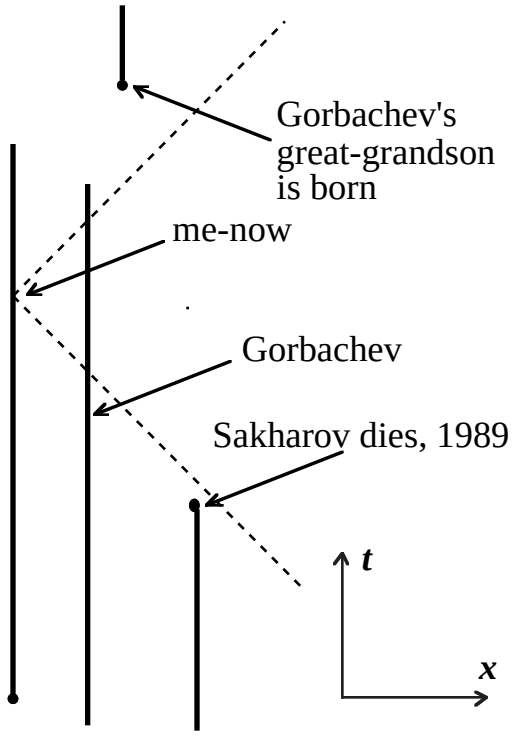

Fig. 3. I coexist*, on 24 October 1998, with Gorbachev, but not with Sakharov or Gorbachev's great-grandson.

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paper deal primarily with *objective*—monadic and relational—matters of fact, not with subjective phenomena, such as perceptions of those facts by conscious beings.

[5] An asterisk is needed to distinguish Coexistence* from the notion of coexistence at work in CE.

[6] I have made, of course, no attempt to draw diagrams, such as Figure 3, "to scale."

I submit that the endurantist who wants to adjust his views to the relativistic context needs the notion of Coexistence*, because this notion allows him to preserve, in that context, important tense-involving intuitions regarding the transient existence of objects other than himself—objects such as Gorbachev and Sakharov, which come to be and cease to exist. The point of introducing Coexistence* is to provide a relativistic basis for a belief to which, arguably, the endurantist is committed: that the existence of other transient things goes hand in hand with her coexistence with them.

In the old pre-relativistic setting, if I am an enduring object fully present at a particular time, there is a sense in which all other transient enduring beings sort themselves out into three different categories: those that *no longer* exist (e.g., Sakharov), those that are *still* or *already* in existence (e.g., Gorbachev), and those that do *not yet* exist (e.g., Gorbachev's great-grandson). It is clear that, in the neo-Newtonian framework, this difference with respect to existence is grounded in the fact that only objects in the second category, and not those in the first and in the third ones, bear a certain relation of coexistence with me-now, namely, the relation of coexistence^{N}*, which is the pre-relativistic analog of Coexistence*:

CE^{N}*: An enduring object E2 coexists^{N}* with E1 fully present at O1 just in case there is a point O2 belonging to the same $HPS^{t_{abs}}$ as O1 (or, simply, absolutely simultaneous with O1), such that E2 is fully present at O2: CE^{N}*(E2, E1^{O1}) $\leftrightarrow \exists$E2^{O2}R^{N}(O1,O2).

What reason do I have to assert, on 24 October 1998, that Gorbachev, but not Sakharov, is *still* in existence? The reason seems clear: Gorbachev, but not Sakharov, coexists^{N}* with me-now. Coexistence^{N}* supplies a necessary link between Gorbachev's continuing existence and Sakharov's being no longer in existence, on the one hand, and my existence today, on the other.

The concept of Coexistence* does precisely the same job in the relativistic framework, by building, not on the relation of absolute simultaneity (no longer valid in that framework), but on the Lorentz-invariant relation of space-like separation. If I am an enduring object fully present at a particular time *and place*, 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 *CE** to me-now, whereas yet others are *still* or *already* in existence (Gorbachev)—because they do coexist* with me-now.

To be sure, Coexistence*, just like its ancestor from CE, conflicts with some of our Newtonian predilections, because it is relativized, not only to time, but also to space. Like its Newtonian predecessor, Coexistence* effectively changes the membership of the set of objects still or already in existence (and, hence, of those no longer and not yet in it) with time, namely, the proper time of a given enduring object. Sakharov is no longer in existence for me-now. But he was still in existence, together with Gorbachev and others, when I was fully present at an earlier point of my world line (that is, when my local time-reckoning device indicated, say, 24 October 1988). See Figure 4.

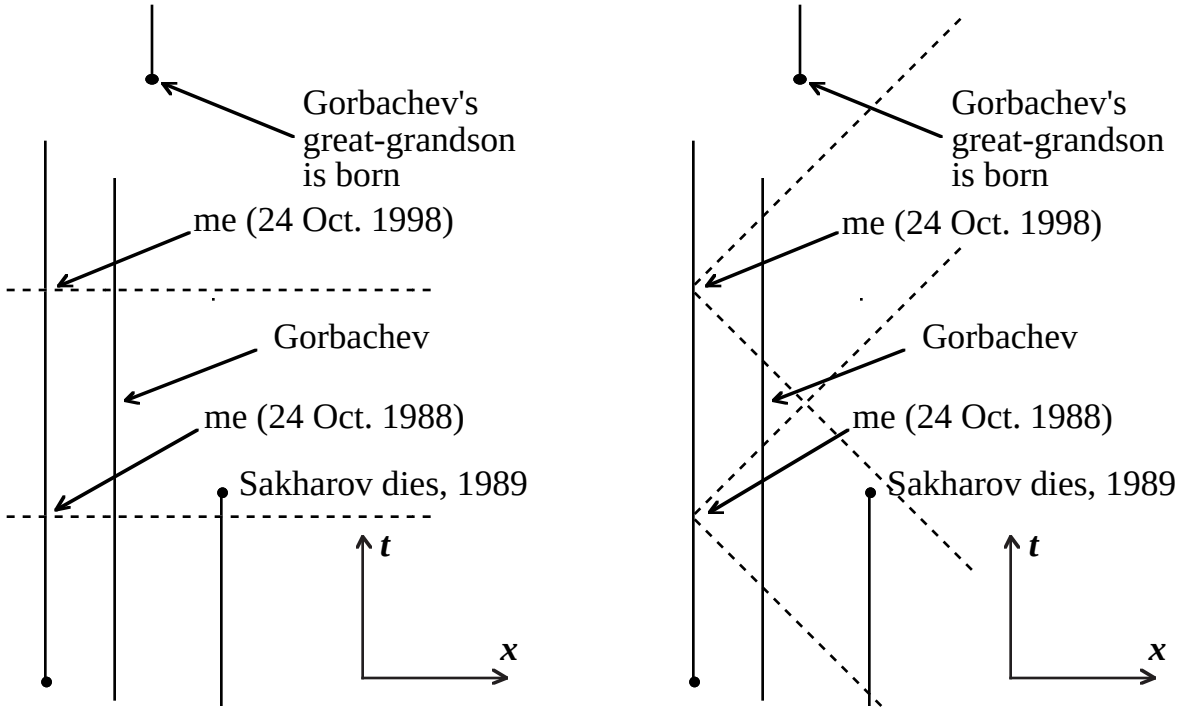

Fig. 4. The endurantist changing perspective on existence. *When* I am fully present on 24 October 1998, Gorbachev is *still* (*already*) in existence, his great-grandson *not yet*, and Sakharov *no longer*. *When* I was fully present on 24 October 1988, *both* Gorbachev and Sakharov *were* in existence. (a) Neo-Newtonian account. (b) Relativistic account.

Quite unlike Coexistence^{N}*, however, Coexistence* makes the distinction among determinations "still (already) in existence," "no longer in existence," and "not yet in existence" relative to a spatial, as well as temporal, location. Speaking metaphorically, one can "revive" Sakharov not only by "going" back in time, but also by "going" further away in space. This is a natural cost (or benefit?) of replacing neo-Newtonian space-time with the relativistic one. Notice, in this connection, that for an enduring object fully present at a certain point of its life career somewhere on Betelgeuse, both Clinton and Napoleon are in existence, the former existing already and the latter still. Alexander the Great, however, is no longer, and Miss America 3000 not yet. The point is that, although "still in existence" and "already in existence" become, in the Minkowski

world, relative to a spatio-temporal perspective and not to a merely temporal one (as they were in the Newtonian world), the question of *what* objects are still or already in existence admits of a definite answer from *any* such perspective. Thanks to CE and its direct descendant, CE*, the 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 space-time.

It is now time to reveal the pernicious side of these temporal determinations. The trouble, as hinted earlier, comes from the "if" part of CE* (and of its ancestor CE) conjoined with the above considerations linking Coexistence* with the existence of transient things surrounding a given enduring object. If an enduring object E1 is at O1, *all* other objects whose world lines are at least partly swept by the "elsewhere" of O1 are *still* or *already* in existence. They are *equally* in existence. Such ontological generosity comes from replacing the absolute present of the Newtonian physics with the much more extensive topological present of SR. This generosity, as already noted, may be regarded as beneficial in some respects,[7] but there are cases where it becomes damaging.

Suppose Sakharov's great-grandson is born at some point in the future. If I am an enduring object fully present at O somewhere on Betelgeuse, I have to conclude, based on CE* and considerations of this section, that Sakharov *still* exists *and* his great-grandson *already* exists. But clearly, there is no *tensed* sense in which they can be in existence together: Sakharov's beginning lies in the *absolute future* of his great-grandfather's end. My conclusion, informed as it is by relativistic considerations, is in strange discord with that relativistically-invariant fact (Figure 5).

[7] By "going" away in space, I can become, in a sense, a "contemporary" of Napoleon.

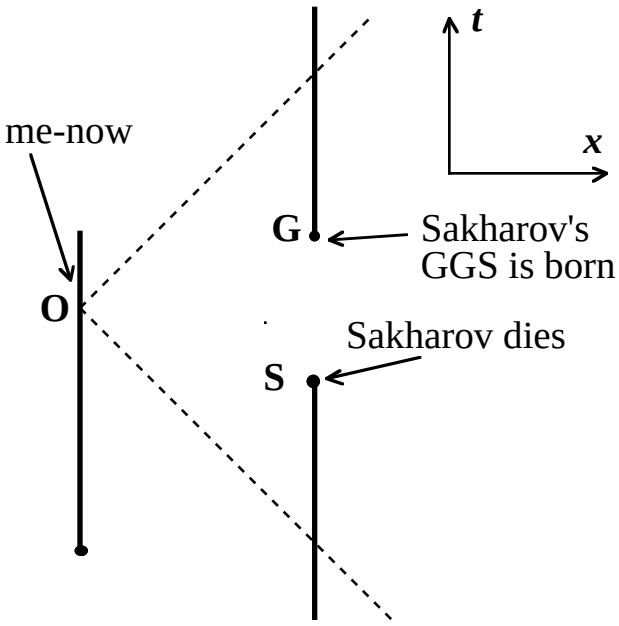

Fig. 5. I coexist*, when I am fully present at O, with both Sakharov and his great-grandson.

But of course, there is a rather innocent tenseless sense, appropriate for the perdurantist ontology, in which Sakharov and his great-grandson are both in existence and one of my parts coexists-P* with both. 'Coexists-P*' here refers to the perdurantist counterpart of Coexistence* governed by the following principle:

(CP*) A perduring object P2 coexists-P* with the O1-part of another perduring object P1 iff P2 has a part located at a point O2 space-like separated from O1: $CP^*(P2, P1^{O1}) \leftrightarrow \exists P2^{O2}(P2^{O2} \in P2 \ \& R \ (O1,O2))$.

My O-part, Sakharov's last part, and his great-grandson's first part all exist atemporally in Minkowski world and are related in a manner that does not imply any troubling tensed determinations, such as "still" and "already." It is not the case that Sakharov's great-grandson *already* exists and Sakharov himself *still* does. They simply exist, as being forever confined to their spatio-temporal regions, and the fact that my O-part coexists-P* with both is a further tenseless fact about Sakharov, his great-grandson, and a part of me.

The notion of being fully present at a space-time point (or a space-time region, in the case of real-life, i.e. spatially extended, enduring objects) retains its central place in the endurantist ontology even in the relativistic context. *Being fully present at a time and place*, just as its Newtonian predecessor *being fully present at a time*, is not something tangential to that ontology; it is, in fact, part and parcel of the very concept of endurance. From the endurantist standpoint, my full presence at a certain time on 24 October 1998 (in a certain part of the continental United States) is the most important fact about my existence, a fact firm enough to ground my perspective on the existence of everything else. To the extent that endurantism may succeed in incorporating an interesting notion of coexistence in the relativistic framework, this notion becomes the only bridge that connects the existence of a given enduring object with the rest of the universe. But this bridge turns out to be *too wide*. It connects me with things that cannot be in existence together in any temporally-loaded sense of "together."

Both endurantism and perdurantism emerge whittled-down out of the transition from the classical to the relativistic conception of space and time. But they are whittled-down to a very different extent. Both views of persistence must abandon the transitivity of the coexistence relation. Having paid this price, the perdurantist discovers, to her satisfaction, that, not only do the troubles stop at this point, but that the new spatio-temporal framework, that of Minkowski space-time, appears to be rather friendly to her, indeed, almost ready-made for accommodating her inherently tenseless ontology. For the endurantist, however, the troubles only begin here. The Minkowski world, having no place in it for absolute simultaneity, presents the endurantist with a dilemma: either to renounce all the tensed implications of her central idea of an object's being fully present at a time (and place), or to endorse these implications and be committed to conclusions that are generally disconcerting[8] and in some cases outrightly contradictory.[9] Neither horn of the dilemma is acceptable for the endurantist. Or so I have argued.

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[8] Except for cases where such conclusions might appear flattering, such as my being a "contemporary" of Napoleon, or even Alexander the Great, depending on the location of a cosmic enduring objects with which we happen to coexist*.

6 .

I conclude that the perdurantist is far better equipped for accommodating the notion coexistence in the context of SR than the endurantist. Since this notion is indispensable to any non-solipsist ontology, the endurantist may be hard-pressed to make a difficult choice among the following options: (1) reject endurantism; (2) reject SR, or (3) try to restore the notion of absolute simultaneity within the framework of SR.

Of these options, (3) is surely the least implausible one for the enduransist. The format of this paper does not allow me to discuss what is really at stake in taking it up.

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[9] I am referring here to the sort of cases illustrated by the story of Sakharov and his great-grandson. A contradiction arises there because the causal and chronological succession of Sakharov's end and his great-grandson's beginning is in conflict with tensed determinations of being already in existence and being still in existence ascribed, respectively, to Sakharov and his great-grandson by an outside enduring observer.

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