Response to McCall and Balashov

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SUMMARY

This paper is an unpublished response to Yuri Balashov and Storrs McCall which was presented at a session of the Philosophy of Time Society devoted to Dr. Craig's *Time and the Metaphysics of Relativity* (2001). Dr. Craig responds to criticisms offered by Balashov and Jensen as well as McCall of his defense of a neo-Lorentzian interpretation of the equations of the Special Theory of Relativity.

RESPONSE TO MCCALL AND BALASHOV

Let me begin by thanking Storrs McCall and Yuri Balashov for commenting on my book *Time and the Metaphysics of Relativity* (*TMR*). It's a genuine honor to have it featured in this meeting of the Philosophy of Time Society. In order to place their criticisms in the proper context, it will be helpful if we can take a step back to look at the wider project in which I'm engaged in this book. *Time and the Metaphysics of Relativity* is part of a broader investigation aimed at determining whether time is tensed or tenseless, that is to say, whether (to borrow McTaggart's convenient terminology) an A- or a B-Theory of time is correct. One of principal arguments for the B-theory is that Special Relativity (SR) requires it. So an examination of the time concept in Relativity Theory is required.

Now a physical theory has two components: a mathematical formalism and a physical interpretation of that formalism. SR has three different physical interpretations, which are empirically equivalent. During the positivist era, these differences were glossed over, since empirically equivalent theories were thought to be merely different linguistic expressions of the same theory. But with the collapse of positivism, the differences between competing physical interpretations of SR can no longer be ignored, since they entail radically different ontologies.

Let me review the three different interpretations which I identified in the book:

1. *The Relativity Interpretation*: This interpretation posits a classical 3+1 ontology of physical objects enduring through time. It postulates a plurality of spaces and times relative to different reference frames. Measuring rods shrink up and clocks slow down relative to these various frames.

2. *The Spacetime Interpretation*: This interpretation posits a 4-dimensional geometry of spacetime points. The central feature of this interpretation is the light cone structure in spacetime, and the familiar notions of reference frames, speed of light, *etc*. play no role in this interpretation. Objects are four-dimensional wholes, whose respective proper times and lengths vary from coordinate system to

coordinate system.

3. *The Lorentzian Interpretation*: This interpretation posits a 3+1 dimensional ontology featuring a privileged time and a privileged rest frame. Lengths contract and time rates dilate in the usual relativistic way only for systems in motion relative to the privileged rest frame.

It's crucial to keep these three interpretations distinct because criticisms of one interpretation may not be applicable to the others. My argument is that SR supports a tenseless theory of time only if the Spacetime Interpretation is shown to be the correct interpretation.

With this wider project in mind, let's turn to my critique of the Relativity Interpretation. There are two issues raised by Balashov's critique: (1) Did Einstein hold to the Relativity Interpretation, and (2) Is the Relativity Interpretation the best interpretation?

With respect to (1) Balashov asserts that the "special relativistic geometry of spacetime was implicitly present in Einstein's 1905 theory." I suspect that this claim is due more to a desire to save Einstein for the Spacetime Interpretation favored by expositors today—to make him one of us—than to a correct historical exegesis. Balashov justifies his assertion by saying that Einstein adopted a "subtractive" strategy in his 1905 paper "by stripping objects of many of their classical properties" like intrinsic length. Indeed, he does; but that in no way implies a rejection of an ontology of 3-D objects enduring through time. Quite the contrary, the very use of reference frames, each with its peculiar time and space, shows that Einstein is thinking of a multiplicity of distinct times and spaces. In any case, he *says* as much, for after embracing Minkowski's spacetime interpretation he wrote: "It appears more natural to think of physical reality as a four-dimensional existence, instead of, *as hitherto*, the evolution of a three-dimensional existence" (*TMR,* p. 79 [my emphasis]). He says, "in the relativity theory we can still use the dynamic picture if we prefer it," but relativity theory favors "the static picture and finds in the representation of motion as something existing in time-space a more convenient and more objective picture of reality" (*TMR,* p. 79). As for the illustration of the magnet and the conductor in the 1905 paper, Einstein's positivism makes it clear that he would have seen the question of whether the current is induced by the magnet's force or by an electric field to be meaningless because the current arises due to merely relative motion, and therefore the question as to its source has no objective significance. What he never doubts is that the magnet and the conductor are three-dimensional objects which endure through time, albeit relative to reference frames. Finally, I am extremely skeptical of Balashov's claim that "Einstein settled for a theory of principle because he was confident that the two postulates on which he built his theory would survive the quantum revolution he saw coming." This claim requires some textual evidence! I suspect that in 1905 Einstein had almost no inkling of what was coming, much less that his two postulates would survive the as yet undiscovered quantum theory. The reason he gave up on a constructive theory, on which he labored (as his correspondence from this time reveals), was that

he couldn't find one.

As for question (2), I was surprised to find Balashov defending the tenability of the Relativity Interpretation, as he has been one of the sharpest critics of this interpretation and a champion of the Spacetime Interpretation. But notice that if he is correct in defending the tenability of the Relativity Interpretation, then it follows immediately that SR does not support the tenseless theory of time but is fully compatible with the A-Theory. It would only require that temporal becoming be relativized to references fames. Indeed, this is precisely the position adopted by Storrs McCall: "temporal becoming itself makes sense only relative to a coordinate frame . . . every inertial frame defines a different partioning of the world into instants, and hence a different, frame-dependent becoming."

But is the Relativity Interpretation the best interpretation? I raised two objections to this interpretation: (1) It results in a fantastic fragmentation of reality, and (2) it is explanatorily deficient. Let's look briefly at each objection in turn.

With respect to (1), it needs to be understood that on the Relativity Interpretation, even if we are merely passing each other in motorcars, we inhabit literally different times and spaces, and at sufficient distances events which are present and real for me are future and unreal for you. But if we come to relative rest, then we share the same reality. Things pop into and out of being just in virtue of our changing our relative motion.

All Yuri says on this score is that if we adopt a "subtractive" strategy, then properties like length are no longer intrinsic but relational properties. That's right; but that does nothing to rebut the charge that on a relativistic 3+1 ontology, we have a fantastic fragmentation of reality which does not afflict Minkowski's 4-D interpretation.

Whether Einstein held to it or not, there clearly is such a thing as the Relativity Interpretation, which is ontologically distinct from a 4-D ontology. McCall, however, claims that there is no difference. He says, "Choice of a 3D or a 4D ontology should not be an either/or but a both/and." These ontologies are just different ways of thinking about the same reality. They are "transformationally equivalent." "The thesis of 3D/4D equivalence holds that whatever can be said about the 3D world of objects moving about and changing in time is translatable without remainder into statements about 4D objects and events in spacetime, and conversely, whatever can be said of 4D objects is translatable into statements about 3D objects."

I could not disagree more. First, there is a certain smell of positivism about the claim that translatability is a sufficient condition for ontological identity. The Relativity Interpretation posits an infinity of distinct times and spaces; the Spacetime Interpretation posits one 4-D spacetime. These are ontologically not the same thing, even if they are "transformationally equivalent." Imagine God creating an entire 4-D

manifold vs. His creating one 3-D slice after another successively. These are clearly diverse ontologies! Second, the translatability thesis fails. This is the burden of my book *The Tensed Theory of Time*. Claims which are permissible within a 3-D ontology, like "The meeting starts now," are not in fact translatable into the tenseless idiom required by the Spacetime Interpretation.

So the Relativity Interpretation and the Spacetime Interpretation are clearly distinct, and the former is fantastic in a way that the latter is not.

With respect to (2) the explanatory deficiency of the Relativity Interpretation, it needs to be understood that the Relativity Interpretation posits 3-D continuants which, for no reason at all, shrink up or dilate due to merely relative motion. In other words, we have absolute effects which are due to merely relative motion. These are unexplained in the Relativity Interpretation, in contrast to the Spacetime Interpretation. Balashov says that a Theory of Principle explains phenomena "by showing that they are entailed by the postulates." But this amounts to saying that the theory does not explain them at all. If you pack enough into the postulates of a theory, you can deduce whatever you want! SR allows us to deduce the phenomena, but it cannot explain why they occur. Balashov defends the Relativity Interpretation by saying that it is in good company because thermodynamics is similarly "deficient." But this illustration supports my position. For classical thermodynamics was explanatorily deficient with respect to the Second Law of entropy increase. It wasn't until a statistical analysis was lent to thermodynamics that the Second Law became intelligible in terms of the greater probability of disorderly states tending toward equilibrium. The original theory definitely was explanatorily deficient, and the statistical approach represented a genuine advance. Even today, the question of the direction of entropy increase remains an explanatory deficiency of thermodynamics and is one of the most hotly debated issues in the field. People don't just dismiss the problem with a wave of the hand by saying, "Oh well, thermodynamics is a Theory of Principle, and so there's no need to seek an explanation of unidirectional entropy increase!" Moreover, I'm surprised to find Yuri treating the postulates of Relativity Theory as resting "on a wealth of empirical evidence." On the contrary, it is empirically impossible to justify the light postulate because we cannot measure the one-way velocity of light.

So the Relativity Interpretation is fantastic and explanatorily deficient. Actually, Yuri, as a champion of the Spacetime Interpretation, should agree with this! Does this imply that we must therefore adopt the Spacetime Interpretation, that the B-Theorist is correct? No, for I argue that a neo-Lorentzian Interpretation is even better than the Spacetime Interpretation.

So let's turn to the question of the justification of the Lorentzian Interpretation. It was interesting to me that neither of my respondents chose to comment on what I take to be the central and most radical thesis of my book, namely, that the classical concept of time is based on metaphysical, and specifically, theological foundations which are immune to the relativistic critique, predicated as it is on essentially

verificationist assumptions which are nearly universally regarded as untenable and obsolete. In particular, I show that Newton's concept of absolute time is based squarely on Newton's theism—which is why, by the way, Newton was fully justified in positing more spacetime structure than his laws of motion required. The foundations of absolute time were not physical, but metaphysical, namely, God's sempiternal duration. My argument is that if God exists and a tensed theory of time is true, then God must be temporal, as Newton believed, and that therefore a privileged simultaneity class of events must exist, in which case a Lorentzian Interpretation must be correct. Lorentz himself recognized the connection of his theory to theism. In a letter to Einstein in 1913 he wrote,

A 'World Spirit' who, not being bound to a specific place, permeated the entire system under consideration or 'in whom' this system existed and who could 'feel' immediately all events would naturally distinguish at once one of the systems *U, U', etc.* above the others (*TMR,* p. 177).

In short, which interpretation of Relativity Theory we adopt will hinge crucially on certain metaphysical issues. The question of the correct interpretation of Relativity Theory is not merely a physical, but a metaphysical question.

For those who are too skittish to talk about God in the context of physical theory, my argument can be freed, I think, from its theistic premiss. For I also argue that there are other metaphysical and physical grounds for preferring the Lorentzian over the Spacetime Interpretation. These are laid out in my volume *The Tenseless Theory of Time*. Note that one of these grounds is *not* that the Lorentzian Interpretation is explanatorily superior to the Spacetime Interpretation. Yuri conflates that claim with my quite distinct claim that the Relativity Interpretation is explanatorily deficient *vis à vis* both the Spacetime and the neo-Lorentzian Interpretations. My argument is rather that there is no good reason to think that such an entity as spacetime exists. To the contrary, I think that such an ontology is susceptible to several powerful objections, which I lay out in the book. So the question is whether a neo-Lorentzian Interpretation is a plausible option for the would-be theist or A-Theorist. In other words, the Spacetime theorist bears the burden of proof to show that a neo-Lorentzian theory faces such formidable defeaters that it should not be embraced.

Balashov's claim that my analysis of the progress of Lorentz's theory in chapter 1 of the book is overly simplistic is both important and interesting. I depended there largely on Eli Zahar's analysis. My aim was merely to examine the objection that Lorentz's modifications of his theory were *ad hoc*. Balashov contends that an adequate neo-Lorentzian theory must assume all the laws of matter to be (or, more accurately, appear to be) Lorentz-invariant. But it is striking that he recognizes that Lorentz had already made that assumption in 1899 and that he had, moreover, "a perfectly good justification" for doing so. This shows clearly that Lorentz's later modifications were not *ad hoc*—indeed, Balashov calls them a "trifle"—*quod erat demonstrandum*. Thus, this issue, while interesting, is not a defeater of the

Lorentzian Interpretation.

But Balashov thinks that there is a defeater lurking in the neighborhood, *viz*., the "no conspiracy" objection. But Balashov's formulation of this objection is significantly different from the traditional objection. The traditional objection is that nature would not conspire, via length contraction and clock retardation, to conceal from us fundamental asymmetries in nature. This traditional objection is rebutted, in part, by the realization that only uniform motion in respect to the fundamental frame is concealed. Acceleration and rotation are not concealed, and Einstein's attempt to extend the Principle of Equivalence to such motions in his General Theory is recognized to be a failure.

But Balashov's "no conspiracy" objection is not about the concealment of asymmetries. Rather it is that Lorentz invariance is a property shared accidentally by all the laws governing systems in space and time. It is, he claims, an unexplained coincidence that laws governing different sorts of matter all share the property of Lorentz invariance.

This objection is based on a misunderstanding. For the characteristic feature of the Lorentzian Interpretation is that it *rejects* Lorentz invariance. As John Bell, reflecting on the violation of the Bell Inequalities, remarked,

I think it's a deep dilemma, and the resolution of it will not be trivial; it will require a substantial change in the way we look at things. But I would say that the cheapest resolution is something like going back to relativity as it was before Einstein, when people like Lorentz and Poincaré thought that there was an aether—a preferred frame of reference—but that our measuring instruments were distorted by motion in such a way that we could not detect motion through the aether . . . that is certainly the cheapest solution. Behind the apparent Lorentz invariance of the phenomena, there is a deeper level which is not Lorentz invariant . . . what is not sufficiently emphasized in textbooks, in my opinion, is that the pre-Einstein position of Lorentz and Poincaré, Larmor and Fitzgerald was perfectly coherent, and is not inconsistent with relativity theory. The idea that there is an aether, and these Fitzgerald contractions and Larmor dilations occur, and that as a result the instruments do not detect motion through the aether—that is a perfectly coherent point of view . . . . The reason I want to go back to the idea of an aether here is because in these *EPR* experiments there is the suggestion that behind the scenes something is going faster than light. Now if all Lorentz frames are equivalent, that also means that things can go backward in time . . . [this] introduces great problems, paradoxes of causality, and so on. And so it is precisely to avoid these that I want to say there is a real causal sequence which is defined in the aether (*TMR,* pp. 226-7).

On this view Lorentz invariance is merely apparent not real.

Now the question does remain: why do all material systems appear to be Lorentz invariant? But this

question is addressed in contemporary neo-Lorentzian theories. For example, Simon J. Prokhovnik essays to explain the apparent Lorentz invariance of all material systems via the retarded potential effect. If he is correct, that explains why all material systems are affected by motion relative to fundamental frame. Note, too, that H. E. Ives was able to derive the Lorentz transformations from the laws of conservation of energy and momentum and laws of transmission of radiant energy. Given these basic laws, the Lorentz transformations will hold for any material system subject to those laws.

Finally, given that there is a preferred frame associated with God's "now" in absolute time, I raise the question, "Does cosmic time provide a sensible measure of God's time?" I argue that this is, indeed, plausible. In the book I dealt with all three of Yuri's objections: (1) The fact that cosmic time is a feature of idealized models which provide only an approximation of our universe at most proves that cosmic time is but an approximate measure of God's time. (2) The contingency of cosmic time only proves that it contingently coincides with God's time. (3) The existence of cosmic time does not depend on a realist construal of spacetime.

As for the evidence from quantum theory, Balashov underestimates the challenge to the received interpretation of Relativity Theory posed by the EPR experiments. There is no plausible solution which does not postulate preferred hyperplanes of simultaneity. The tide has turned, and the evidence is now beginning to fulfill Lorentz's prediction: "In my opinion it is not impossible that in the future this road, indeed abandoned at present, will once more be followed with good results, if only because it can lead to the thinking out of new experimental results" (*TMR,* p. 234).

References

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