

Putnam and the Reality of Time

Somayeh Tohidi*

Abstract

In his famous article ‘Time and Physical Geometry’, Putnam claims that the presentist view of time is inconsistent with Special Theory of Relativity (STR). He provides two main formulations for his argument. In this paper, I first reveal the logical flaw in his first formulation. Second, I will show how it can be amended. Third, I show how his second formulation is logically sound, given my analysis of his first formulation. Finally, and based on these logical evaluations, I show that Sklar’s criticism of Putnam’s argument is not well founded.

Introduction

Putnam’s article¹ is well-known for using special theory of relativity (STR) to argue against presentism. In his article he argues that STR has falsified presentist view of time, i.e. the metaphysical view that all and only things which are in my present are real. In his argument he introduces a criterion for reality in terms of a physical relation R, i.e. he says all and only things which are in relation R to me are real. But he does not get into the detail of what R is. He also assumes that if one wants to decide about reality of objects based

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¹ Putnam, ‘Time and Physical Geometry.’

on their being in relation R to an observer, then all observers are on a par and no observer has a privileged status. So the fact that the proposed criterion of reality (CR) has been stated in terms of relation R to me, does not confer any privileged status to me, and this criterion can be stated in terms of relation R to any observer. This principle is known as the principle of no privileged observer (NPO). Putnam then infers from this principle that relation R in the criterion of reality is transitive. This inference is one of the most-criticised steps of Putnam's argument, since he does not provide any justification for it.

In this paper, I will give a logical analysis of Putnam's inference and prove that it is not logically sound. I will also suggest a way to amend it, i.e. I will propose a weaker conclusion which can be inferred from NPO and suffices for Putnam's argument. I will also show that Sklar's criticism of Putnam's argument, which is based on criticizing this step of his argument, is not well founded. Putnam provides two main formulations of his argument against presentism. These formulations differ in terms of their premises and logical structure.² In the first section, I will give a precise account of the first formulation and identify the dubious step. In the second section, I will logically analyse this step and falsify it. Then I will propose an alternative step to replace the falsified one. In the third section, I will show Putnam's second formulation of his argument is logically sound. In the final section, I will assess one of Sklar's criticisms towards Putnam's argument and show that it is not well founded.

I. The First Formulation

In this section, Putnam's first formulation of his argument against presentism is rigorously analysed. In this formulation he argues that if 'all things that

² In fact he gives *three* formulations. But one of them (the one on the 3rd page) is more like a warm-up and apparently is just intended to pave the way for the other two. That's because just after finishing it, Putnam point to a flaw in it and explains why it does not work. The first main formulation is on the 4th page of the paper (Ibid, p.243) and the second one is on the pages 7-8 (Ibid, pp.246-7).

exist now are real' then 'there is an event in future which is real'. Here is his argument:

1. All things that are simultaneous to me-now are real. (Assumption)
2. There is a relation R such that all and only things that stand in relation R to me-now are real. (Criterion of Reality) (Assumption)
3. For any observer O, if it is the case that all and only things that stand in relation R to me-now are real and observer O is real then it is also the case that all and only things that stand in relation R to observer O are real. (No Privileged Observer) (Assumption)
4. (1) and (2) imply that 'all things that are simultaneous to me-now are in relation R to me-now'.
5. (2) and (3) imply that R is transitive.
6. (4) can be considered as a law of nature and according to STR laws of nature are the same for all inertial observers. Therefore if you-now are an inertial observer then 'all things that are simultaneous to you-now are in relation R to you-now'.
7. You-now are simultaneous to me-now and is moving relative to it, with a velocity that is considerable with respect to speed of light. (Assumption)
8. (7) and STR imply that there is an event x which is in future of me-now but simultaneous to you-now. (Figure 1)
9. (8) and (6) imply that event x is in relation R to you-now.
10. (7) and (4) imply that you-now are in relation R to me-now.
11. (5), (9), (10) imply that event x is in relation R to me-now.
12. (11) and (2) imply that event x is real which means there is an event in future of me-now which is real.

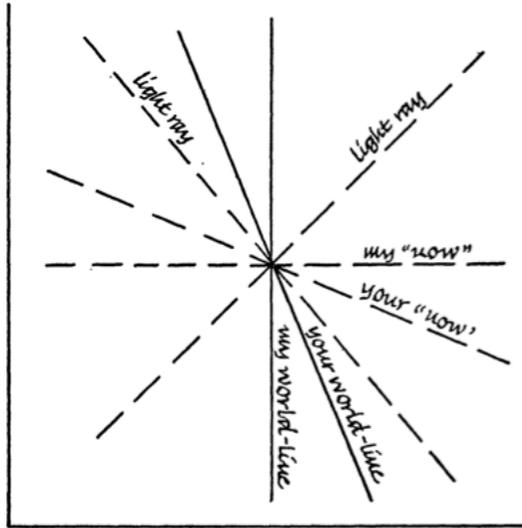


Figure 1³

Let's go through the assumptions of this argument to see where they come from. Line (1) is the antecedent of the conditional proposition this argument is trying to prove, i.e. if 'all things that exist now are real' then 'there is an event in future which is real'. So, it is reasonable to include it as one of the premises and then try to reach the consequent of that proposition. Line (2) is an important assumption. Putnam's notion of reality is absolute and not relative, i.e. he never talks about 'reality to an observer.'⁴ However, he introduces a criterion for this absolute notion of reality in terms of a physical relation R, which is line (2) of the above argument:

Criterion of Reality (CR): All and only things that stand in relation R to me-now are real.

³ Norton, *Einstein for Everyone*

⁴ This point is very important when we come to investigate Sklar's criticism of Putnam.

In line (3) Putnam is referring to his third assumption about realness. He believes there is no privileged observer that can be considered as the sole reference for determining whether things are real. Every real observer is on a par with any other in this regard. That is, if the realness of things can be determined by checking whether they have a certain relation to me-now, then their realness can also be determined by checking whether they have that relation to any other real observer. Line (7) is the second among the three assumptions Putnam makes about realness: '(ii) At least one other observer is real, and it is possible for this other observer to be in motion relative to me.'⁵

Now that we know all the assumptions, let's go through the steps of the argument. Line (4) of the argument is logically straightforward, but it contains the following point, which is very important for our discussion in the fourth section of this paper: In this line, relation R has not been taken to be equivalent to simultaneity. Simultaneity is just a subset of relation R, according to line (4). So for Putnam, relation R is a physical relation but not simultaneity.⁶ Line (6) looks like a further assumption but Putnam introduces it as an implication of STR. According to this line of the argument, the sentence 'all things that are simultaneous to me-now are in relation R to me-now' can be considered as a law of nature, i.e. it is true for every inertial observer. This may be justified by a simple reductio ad absurdum. Let's assume the above sentence (line (4) of the argument) is not true for every inertial observer and only true for me-now. Then it means relation R, which is a physical relation, has specified a simultaneity, i.e. my simultaneity, which is different from others and this is against STR, according to which there is no absolute simultaneity. Line (8) is one of the key points of Putnam's argument. As Figure 1 illustrates, there are infinitely many events which are on your simultaneity

⁵ Putnam, 'Time and Physical Geometry' 241

⁶ In one occasion in his paper, Putnam takes relation R to be the relation of simultaneity and argues based on this assumption. But at the end of his argument, he says this argument does not work because 'simultaneity to an observer in his coordinate system' is not transitive.

hyper-surface (simultaneity line in the above figure) but above my simultaneity hyper-surface, and this is exactly what line (7) claims. Looking at other steps of the argument, one will find them logically straightforward, except for line (5). It is not clear how NPO and CR imply transitivity of R. The curious thing is that Putnam does not give any justification for either of these claims. The missing link between NPO and transitivity of R is well known in the literature about Putnam's paper. For instance Sklar writes:

Why one would think that such a doctrine of 'No Privileged Observers' would lead one immediately to affirm the transitivity of 'reality for', given that one has already relativised such previously nonrelative notions as that of simultaneity, is beyond me.⁷

In fact Putnam makes two claims about the relation between NPO and transitivity of R:

1. If NPO holds then R in CR is transitive. He says: 'what the principle that There Are No Privileged Observer requires is simply that the relation R be transitive.'⁸
2. If the relation R in CR is transitive then NPO holds. He writes: 'the principle III is satisfied because the relation of simultaneity is transitive.'⁹

Here, principle III refers to Putnam's third assumption about realness, which he also calls NPO. To check whether either of these claims holds, it will be more convenient to talk in a formal language.

II. Logical Analysis of Putnam's Claims

Before starting to formally examine Putnam's claims, one point is necessary. As I said before, Putnam explicitly refers to his third assumption about real-

⁷ Sklar, *Philosophy and Spacetime Physics* 291.

⁸ Putnam, 242.

⁹ *Ibid.*, 241.

ness as the principle of No Privileged Observer. Here is his third assumption about realness:

(iii) If it is the case that all and only the things¹⁰ that stand in a certain relation R to me-now are real, and you-now are also real, then it is also the case that all and only the things that stand in the relation R to you-now are real.¹¹

By closely examining the third assumption, we will understand that it is not general enough and can only be considered as one consequence of NPO. Assumption (iii) is about you-now (one specific observer) and is saying that if realness of things can be determined by their relationship to me-now then their realness can also be determined by their relationship to you-now. Nevertheless NPO in its general form talks about any real observer, i.e. it says if realness of things can be determined by their relationship to me-now then their realness can also be determined by their relationship to any other real observer.

In what follows, I will translate into formal language the general form of NPO, and not assumption (iii), which is just one instance of the general form.

- x, y : variables
- i : I-now
- Lx : x is real
- xRi : x stands in relation R to me-now
- Criterion of Reality (CR): $\forall x(Lx \leftrightarrow xRi)$
- NPO: $\forall y((\forall x(Lx \leftrightarrow xRi) \wedge (Ly)) \rightarrow \forall x(Lx \leftrightarrow xRy))$

As we can see, NPO and CR are sentences in first order logic. These sentences have different values under different interpretations. That means, even if we fix the domain of discussion (D), different combinations of the sets R and

¹⁰ In this context the term ‘things’ refers to any event or observer in space-time.

¹¹ *Ibid.*, 241.

L, lead to different truth values for NPO and CR. It seems the claim Putnam proposes is that:

1. If NPO and CR are true under an interpretation then that interpretation contains a transitive R.
2. If CR is true under an interpretation and that interpretation contains a transitive R, then NPO will also be true under that interpretation.

In what follows, I use semantic analysis of NPO to argue that both of these claims are false. To falsify the first claim, one interpretation that contains a non-transitive R, but renders NPO and CR true would suffice. Consider the following interpretation:

$$D = \{i, u, e\}$$

$$R = \{(i, i), (u, i), (i, e), (u, u), (i, u)\}$$

$$L = \{i, u\}$$

In order to simplify the logical calculations, in this interpretation, I have assumed that there are only three objects in the domain: I-now and two other things. Under this interpretation:

- $v(\forall x(xRi \leftrightarrow Lx)) = 1$
because for every x-variant v' of v , $v'(xRi) = v'(Lx)$
- $v(\forall y[(\forall x(Lx \leftrightarrow xRi) \wedge (Ly)) \rightarrow \forall x(Lx \leftrightarrow xRy)]) = 1$
because for $y = i, u$: $v(Ly) = 1$ and $v(\forall x(Lx \leftrightarrow xRy)) = 1$
and for $y = e$: $v(Ly) = 0$ and $v(\forall x(Lx \leftrightarrow xRy)) = 0$.

So the values of NPO and CR under this interpretation are 1. However the set R in this interpretation is not transitive, because $(u, i) \in R$ and $(i, e) \in R$, but $(u, e) \notin R$.

One may object the above falsification by saying that if we take the domain of interpretation (D) equal to the set of real things (L) then NPO and CR imply transitivity of R. In other words R is transitive among real things. This

is true but this conclusion, i.e. transitivity of R among real things is not sufficient for Putnam's argument. Because when in step (11), we infer that event x is in relation R to me-now, we don't yet know it is real. Let's examine the second claim. To falsify this claim, it suffices to introduce an interpretation v , which contains a transitive R that makes CR true and NPO false:

$$\begin{aligned} D &= \{i, u, e\} \\ R &= \{(i, i), (u, i), (e, i)\} \\ L &= \{i, u, e\} \end{aligned}$$

- $v(\forall x(xRi \leftrightarrow Lx)) = 1$,
because for every x -variant v' of v , $v'(xRi) = v'(Lx)$
- $v(\forall y[(\forall x(Lx \leftrightarrow xRi) \wedge (Ly)) \rightarrow \forall x(Lx \leftrightarrow xRy)]) = 0$,
because for $y = e, u : v(Ly) = 1$ but $v(\forall x(Lx \leftrightarrow xRy)) = 0$.

Therefore under this interpretation, the value of NPO is 0 and the value of CR is 1. However, the relation R in this interpretation is transitive. So it seems that Putnam's claims about the relation of NPO and transitivity of R are provably false. However that is not the end of the story. Putnam's main claim, which is vital for his argument against presentism, is the first one, i.e. if NPO and CR hold then R is transitive. In fact Putnam can derive a weaker conclusion from NPO and CR which would suffice for his argument. He can claim:

For any two observers u and e , if e stands in relation R to u , and u stands in relation R to me-now then e is real.

In a more formal language:

For all e and u , if $(e, u) \in R$ and $(u, i) \in R$ then $e \in L$

It is important to note that the above claim is not tantamount to transitivity of R. That's because we have fixed one of the observers, i.e. me-now. Here is the proof of this claim:

Take the domain of interpretation be $D = \{i, u, e\}$. Since $v(CR) = 1$ and $(u, i) \in R$, so $u \in L$. That means for $y = u$, the value of left hand side (LHS) of NPO is 1. On the other hand we know $v(NPO) = 1$. That means for every y the value of LHS and RHS is the same. Therefore for $y = u$, the value of RHS is 1, i.e. $\forall x(Lx \leftrightarrow xRu)$. On the other hand we have assumed $(e, u) \in R$. So $e \in L$.

The fact is that the above statement suffices to rescue Putnam's argument. The only thing we need to do is to replace line (5) of the argument by this weaker conclusion and everything else will be fine (except for some minor modifications including merging lines (11) and (12)).

III. The Second Formulation

Everything I discussed so far was about Putnam's first formulation of his argument. In his second formulation Putnam adds an assumption to his argument and draws a stronger conclusion. He argues that if 'all things that exist now are real' then 'everything in future and past is also real'. He does so by adding the assumption that for every event x in space-time there is an observer o such that x is in relation R to o and o is in relation R to me-now. By adding this assumption to the argument mentioned before, he can conclude that every event in space-time is real.

However Putnam's second formulation differs from the first one, not only in terms of the above assumption but also in one of the steps. In fact he replaces line (5) of the first formulation by the following:

Principle III then requires that I also count every thing and event which bears the transitive closure of R to me (i.e., which bears R to me, or which bears R to something that bears R to me, or which bears R to something that bears R to something that bears R to me, or...) as real.¹²

¹² Ibid., 246.

This inference is exactly the weaker conclusion I mentioned above. In this quotation Putnam infers from NPO, the reality of those objects which are in the transitive closure of R to me, and not transitivity of R in general.¹³ So this second formulation does not have the problem of the first formulation and is logically sound.

IV. Sklar's Criticism

In this section I will argue that Sklar's account of Putnam's argument is not precise and that is why some of his criticisms towards Putnam are not well founded. Here is Sklar's account of Putnam's argument:

Consider an observer at a place-time. According to the doctrine in question, events in his future (say) are not determinately real. But according to relativity there is going to be another observer, coincident with the first, and hence certainly real to him, since immediately present to him. Now many of the events future to the first observer will be present to the second, so long as the two observers are in relative motion. Indeed, for any future event (relative to the first observer and spacelike separated from him) there will be a second observer such that that event is present to the second observer when the second observer is coincident with the first. So the 'future' event will be real, relative to the second observer. But surely 'being real to' is a transitive notion. If the event is real to the second observer who is real to the first, it must be real to the first observer, contradicting our original claim that events future to an observer lack reality for him.¹⁴

¹³ He does not mention any reason for making this change. He uses this second formulation only to infer a stronger conclusion about reality of everything by introducing a further assumption. So I presume he was not aware of the fact that inferring this weaker conclusion is logically sound while inferring transitivity of R is not.

¹⁴ Sklar, 290.

First, in this account Sklar has taken reality to be a relation. However, as we have seen, the notion of reality for Putnam is not a relation but a predicate. Putnam introduces a criterion in terms of a physical relation (R) for reality. And in the rest of his argument, he only deals with this physical relation of R and not the relation of ‘reality for’.

Second, in this account, Sklar has assumed the transitivity of the relation of ‘reality for’, while Putnam does not assume transitivity of R but infers it from NPO. The curious point is that Sklar is aware of this fact and says, elsewhere in his paper as I quoted before,¹⁵ that he does not understand how Putnam infers transitivity of R from NPO. So, maybe since he thinks this inference is unjustifiable, he omits this step altogether in his account of Putnam’s argument. He then targets this assumption, i.e. transitivity of ‘reality for’ and says it is not a plausible assumption, considering the fact that the relation of ‘simultaneity for an observer’ is not transitive in Minkowski’s space-time.

Even if we put aside all the mentioned shortcomings of Sklar’s account of Putnam, and assume he is talking about non-transitivity of the physical relation of R, his criticism is still not effective. This is because non-transitivity of the relation ‘simultaneity for an observer’ does not have anything to do with non-transitivity of R. Putnam, in his argument has not taken R to be equivalent to the relation of simultaneity. For him, the latter is a subset of the former. So, one cannot infer non-transitivity of R from non-transitivity of simultaneity.

Conclusion

It has been shown in this paper that a precise investigation of Putnam’s arguments would reveal that his first formulation is logically flawed, but his

¹⁵ ‘Why one would think that such a doctrine of ‘No Privileged Observers’ would lead one immediately to affirm the transitivity of ‘reality for’, given that one has already relativised such previously nonrelative notions as that of simultaneity, is beyond me.’ (Sklar, 291.)

second formulation is sound. The logical flaw is about the link between the principle of no privileged observer (NPO) and transitivity of relation R. It was proven that NPO does not imply transitivity of relation R. However, it implies a weaker conclusion and that is everything, which bears to me the transitive closure of R, is real. This weaker conclusion suffices for Putnam's argument.

Having these in mind, I have shown that Sklar's account of Putnam's argument is not precise and therefore his criticism of Putnam is not well founded. That is, because Sklar's criticism is based on the assumption that Putnam takes R to be equivalent to the relation of 'simultaneity for an observer', while he does not.

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Somayeh Tohidi is a MSc student in Philosophy of Science at the London School of Economics and Political Science (2013-2015). She did her BSc in Chemical Engineering at Sharif University of Technology back in Tehran. Her interests cover general issues in philosophy of science, logic and set theory, and philosophy of mind. She hopes to continue research in the future. You can contact her at [somayehtowhidi@gmail.com]