

FREE-WILL IN THE BLOCK UNIVERSE? OLD AND NEW PROBLEMS WITH TIME TRAVELS

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Resumen: Este artículo discute la tesis de Carl Hoefer en su artículo 'Freedom from the inside out': para hacer el universo-bloque compatible con la voluntad libre, basta con evitar las intuiciones presentistas que asociamos intuitivamente con acciones libres. Mostramos una posible dificultad de esta propuesta: si partimos del universo-bloque, ciertas acciones libres podrían quedar ligadas de un modo incompatible con la libertad. Esto se muestra de una forma gráfica que a menudo se utiliza para discutir la libertad en el universo-bloque, mediante un experimento mental con máquinas del tiempo. Esta dificultad no depende de la existencia real de tales máquinas.

Palabras clave: El tiempo en el universo-bloque, Experimentos mentales con viajes en el tiempo, La voluntad libre en el universo-bloque.

Abstract: This paper discusses Carl Hoefer's thesis in his article 'Freedom from the inside out': to make the block universe compatible with

free-will, one must avoid presentist intuitions intuitively associated to free actions. We show a possible difficulty of this proposal: the assumption of the block universe can imply that certain free actions would be cross-linked in a way incompatible with freedom. This is shown in a graphical way often used in the discussion of freedom in the block universe, by means of a thought experiment with time machines. This difficulty does not depend on the real existence of those machines.

Keywords: Time in the block universe, Time travel thought experiments, Free will in the block universe.

1. Introduction

Since Einstein's theories of special and general relativity were accepted by the scientific community, a good deal (perhaps most) of the specialists in this branch of physics have favored the world image called the *block universe*. According to this conception, the special relationship between *present* and *existence* which seems to derive from our ordinary experience, –which is asserted by the most opposite time theory, the *presentist theory*,– is just an illusion. In reality, every point in space-time making up the universe would exist a-temporally (as a block); given a reference system, the only temporal relations with a physical significance would be *before* and *after*: and the temporal modes *past* and *future* would just designate certain points of the a-temporal block which are not accessible (*no longer*, or *not yet*) from a given point.¹

1) For simplicity, in this article we refer to the *presentist theory* as the alternative to the *block universe*, because it is the most opposite to the latter, with regard to the relationship between time and existence. While the block universe theory postulates that all points of spacetime exist in the same way, timelessly, the presentist theory postulates that only the present exists, however defined. To be precise, it is important to keep in mind that the presentist theory is actually a representative of a larger family of conceptions of time which argue that existence is linked to type A time series (past, present and future series). Another representative of this family of proposals, for example, is the so-called "growing block" conception, according to which the past and the present do exist (in fact, the present would be the point of coming into existence), while the future does not yet exist. With respect to the arguments developed in this article, it is not important which

Among the discussions motivated by this world image, one of the first was its compatibility or incompatibility with human freedom. That this problem was posed, was logical: if every point in space-time, with its material contents, exists a-temporally, the *future* (however we define it) is as real, and therefore as rigidly defined, as the *present* or the *past*. In this scenario, how would it be possible to fit the idea that man's free decisions determine (or co-determine) world events? What is the meaning of terms such as *options*, *decisions*, *unrealized possibilities*, and so forth, in the context of the block universe?

The most relevant attempt in recent literature to confront these questions was made by Carl Hoefer, especially in his article 'Freedom from the inside out'.² Our paper attempts to show a possible difficulty in Hoefer's approach, derived from the fact that, in the block universe, it is possible (in theory) to entangle pairs of actions in such a way that they do not appear compatible with the idea that those actions are free.

To show this difficulty in an easy way, we shall employ a graphical procedure which has been used frequently in the discussion of the problem of free will in the block universe: thought experiments consistent with time-travel to the past. The reason for this can be shown in three steps:

First, we must remember that time travel (specially a trip to the past, or a two-way trip) would only be possible in the block universe. In the presentist alternative, the past does not exist; therefore traveling to the past makes no sense.³ On the contrary, in the block universe, a two-way trip in time is nothing but a temporal closed curve inside the a-temporal existence block, and it is well-known that at least some solutions of Einstein's field equations give rise to temporal closed curves.

of the versions of this family is considered most appropriate, because all of them share the same decisive point for the issue discussed here: the causal priority of the past with respect to the future, derived from its precedence in existence.

2) Carl Hoefer, "Freedom from the inside out", *Royal Institute of Philosophy Supplement* Vol. 50 (March 2002), 201-222. DOI: 10.1017/S1358246100010572.

3) Most specialists in the philosophy of time agree with this statement. However, even a thesis apparently so obvious as this has been questioned. See, for example: Bradley Monton, "Presentists can believe in closed timelike curves" *Analysis* 63/3 (2003): 199–202.

As a second step, if we allow that temporal closed curves can exist in a block universe, time travel could bring us to situations where human freedom and the consistency of the world could clash. The typical, best-known and well-discussed case is the *grandfather paradox*, where a time traveler decides to kill her grandfather before he came to know her grandmother. If this were possible, the existence of the time traveler in time would become inconsistent. But why wouldn't she be able to do it?

Three, although these thought experiments are formulated in terms of time-machines, they are actually independent of the possibility that these machines can really exist or not.⁴ Their real use is the fact that they make it possible to present intuitively the consequences of closed temporal loops that include human actions in the events they enclose. Whether these temporal curves can be artificially generated is not relevant here. We are only interested in the fact that a generic block universe could contain them.⁵

What we intend, therefore, is present the graphical resource of a new variant in the family of thought experiments about time travel to try and throw a little more light on the discussion on the compatibility of free will with the block universe. In particular, we will try to use this variant of the experiment to formulate a possible difficulty for Carl Hoefer's recent defense of the compatibility of free will and determinism in the context of the block universe.

For this goal, the remainder of the article will be divided in the following way:

In the second section, we shall summarize the classical objection to the compatibility of the block universe with free will –the *grandfather paradox*– and the most significant answers it has received. We'll conclude

4) About the state of the art in the discussion about the actual possibility of the existence of time-machines, and their importance for the discussion on the philosophical aspects of the theories of space-time, see John Earman, Wüthrich Christian and John Manchak, "Time machines", in *The Stanford Encyclopedia of Philosophy*, (Summer 2016 Edition), ed. Edward Zalta, URL: <http://plato.stanford.edu/archives/sum2016/entries/time-machine/>. (Last time consulted March 2016).

5) This result was established in Kurt Gödel, "An example of a new type of cosmological solutions of Einstein's field equations of gravitation" *Reviews of Modern Physics* 21 (1949): 447-450.

that the most promising answer is the one that sees the problem of this paradox as an inconsistent mix of the presentist theory of time with the scenario of the block universe. In this section we'll follow mainly Paul J. Nahin's analysis.

In the third section we'll outline a proposal which tries to fit together the block universe with free will, starting from the same intuition used in the case of the grandfather paradox in the previous section. This is Carl Hoefer's proposal, which presents freedom as co-determination, where all the decisions taken in every instant come together.

In the fourth section we'll try to show with the help of new thought experiments about time travel, that Hoefer's proposal does not take into account the possibility of action entanglement incompatible with freedom in the block universe. These experiments will show that in the block universe the most elementary actions could be entangled with other actions in the past or the future, in such a way that the idea of free decision in such situations makes no sense.

2. Time travel and free-will: the grandfather paradox

Since Hermann Minkowski reformulated special relativity in 1908 in terms of a four-dimensional continuum, the way was open to conceive the universe as an a-temporal block. If this perspective is accepted, it makes sense to pose the possibility of a trip from any point to another one, in the subset of points of that continuum causally connected to a given point. However, moving from one point to another in that subset would mean, in many cases, not just space travel, but time travel too. Is this possible? The development of general relativity theory and, above all, the discovery that there are solutions of the field equations of this theory which describe closed temporal curves, seem to indicate that, at least in some circumstances, the answer could be positive.

The idea of time travel was popular much before the technical developments that suggested its possibility in the block universe. This idea gave rise to a science-fiction genre and simultaneously to a still standing

controversy about the supposed or real paradoxes that those travels would generate. One of these paradoxes, the *grandfather paradox*, suggests that human freedom is inconsistent with time travel, thus indirectly pointing at an inconsistency of human action and the block universe.

The first formulation of the grandfather paradox is usually attributed to the French writer René Barjavel, who developed it in his novel *Le Voyageur imprudent* (1943). However, the paradox is mentioned as a well-known concept in a letter published in the magazine *Amazing Stories* (February 1931), in the following words:

'[I]f time traveling were a possibility there would be no need for some scientist getting a headache trying to invent an instrument or "Time-Machine" to "go back and kill grandpa" (in answer to the age-old arguments of preventing your birth by killing your grandparents I would say: "who the heck would want to kill his grandpa or grandma!").⁶

Of course, the problem is not whether someone would have the idea of doing something like that, but if they would be able to do it.

It looks, therefore, that a travel to the past would imply a restriction to the actions that the travelers could perform. Concretely, they could never do anything that would break somehow the logical consistency of their own cosmic line, and therefore of space-time. The question is: what does this restriction mean? In other words, how will the contradiction be avoided? In a contingent way? (e.g. the murdered misses). As the result of a physical effect? (i.e. an irresistible impulse).

In the first case, it would seem that time travel in the block universe is incompatible with human freedom, since what the agents decide does not depend only on their will, but on other external circumstances. However, time travelers who discover their errors could in principle try out once and again. How can we accept the scenario of a continual casual frustration of their murderous (or suicidal) attempts? This brings us to the more intriguing proposal that certain actions will not be performed, not because of external circumstances, but as a result of a pre-determination of the traveler's will.

6) Quoted in Paul Nahin, *Time Machines* (New York: Springer, 1999): 255.

The time travelers would plan their action assuming that they are free, but in the final attempt their mind would necessarily decide not to do it, thus proving that free will would be illusory in certain circumstances. But it would be hard to believe that time travel causes a loss of free will. And, as the actions to be performed are ordinary human actions, the conclusion would be that free will must be an illusion... at least in the context of the block universe.

Can this argumentation be answered in some way?

In his study about the question of time travel, perhaps the currently largest one which considers both the physical, philosophical, literary and theological points of view, Paul J. Nahin comes to the conclusion that the answer is not actually difficult.

'Can the time traveler kill the boy (himself)? As I have argued up to this point, the answer is yes, but also that he won't because he didn't. The fact that he won't (didn't) doesn't mean he can't (couldn't)'.⁷

The grandfather paradox appears, according to Nahin, because many authors do not take into account the following two elements: First, that it's one thing to influence the past and another one to change it. Secondly, that the past does not occur several times in a time travel situation. In other words, the problem appears when time travel is considered as a new happening. Thus conceived, it looks like the time traveler could take, in each case, a different decision. But a time travel would just be a closed time curve, which means, in the block universe perspective, that the line exists a-temporally, that every instant contains a-temporally all the decisions taken at that point, the time traveler decisions included. The past does not occur several times, therefore the decisions taken by the time traveler influence the course of history, but do not change it.

In other words, the paradox appears when we mix the idea of time in the block universe with the presentist idea, where the only real instant is the present. If we accept presentism, a time travel (actually impossible by

7) Paul Nahin, *Time Machines* (New York: Springer, 1999): 292. The various positions on the grandfather paradox and Nahin's own position are developed extensively in chapter 4 of this work

definition, but let us consider for a moment this *ab impossibile* situation) would be a new occurrence, a recovery of the existence of beings and situations which no longer existed. If things would happen again, things could happen in a different way, and inconsistencies could appear. But in the block universe time travel would not pose these problems, for nothing new happens there.

This reasoning suggests an interesting line of thought. What appeared initially as an objection against the time traveler freedom, the *grandfather paradox*, would be nothing else but the confusion between the presentist conception of time and the block universe conception. More generally, it would be a confusion between an idea of the time which means that existing things become real step by step, in a true progression described in terms of past-present-future (what philosopher McTaggart called a type A time series) and the idea of time as a form of distance within a timelessly existing block. From this comes the next question: is it possible that the thesis of the inconsistency of free will and the block universe comes from this confusion? This thesis, recently assumed by Carl Hoefer, will be described in the next section.

3. Freedom in the block universe, according to Carl Hoefer

In his interesting paper mentioned above, Carl Hoefer has tried to prove that free-will is compatible with the block universe. This assertion is rejected by many, because –as is typically argued,– in the block universe future actions are completely determined by the cosmic state in the past. Hoefer, however, asserts that the preponderant role of the past as the cause and determination of everything else has meaning only in a presentist theory of time (or one of its variants, such as the “growing block”), according to which the past existed first. But in the context of the block universe, the special role of the past makes no sense, since every instant exists a-temporally.

Rather than starting from a first state of the universe which would give rise to everything else, Hoefer asserts that, in a block universe, free-will means the fact that every free decision co-determines (entails) both past

and future states of the universe. Therefore we should not be surprised if future events entail present events and vice versa. In some way, all the decisions would be decided together. To quote him:

‘The idea of freedom from the inside out is this: we are perfectly justified in viewing our own actions not as determined by the past, nor as determined by the future, but rather as simply determined (to the extent that this word sensibly applies) by ourselves, by our own wills. In other words, they need not be viewed as caused or explained by the physical states of other, vast regions of the block universe. Instead, we can view our own actions, qua physical events, as primary explainers, determining –in a very partial way– physical events outside ourselves to the past and future of our actions, in the block.’⁸

Once again, the confusion between the presentist conception and time in the block universe would generate the appearance of the lack of freedom.

In this context, we can consider the question of the actual meaning of ‘co-determination’. Hofer explains it thus: The fact that we can and do take a decision implies that past states of the universe around us make it possible for us to take that decision. Past states that make that decision impossible are excluded. Usually the number of past states that entail our present decision is very large, and it is precisely this that makes our freedom possible. In a similar way, our current decision becomes a part of the set of present states of the universe which will entail future states. This entailment must not be confused with a causal influence.

Another interesting idea is the fact that all the entailments coming from the past toward the different free decisions taken by billions of human beings must be harmonized, and the same must happen with entailments toward the future. Obviously again, the past states of the universe must make possible, not only the free decision of a single person, but of all of them together.

Thus: Every free decision co-determines (entails) both past and future states of the universe.

8) Carl Hofer, “Freedom from the inside out”, *Royal Institute of Philosophy Supplement* Vol. 50 (March 2002), 201-222. DOI: 10.1017/S1358246100010572. pp.207-208.

However, this proposal would be significantly affected if we could prove that, at least in certain cases, the behavior of a person in the future is not just entailed by the many states of the universe compatible with it, but logically determined by a single component of that set of states: by the behavior of the same person in the present. How can we be free, if our present behavior can completely determine our future behavior, regardless of every other component of the state of the universe, in even trivial situations?

To see that this determination can occur in the context of the block universe, we'll next pose a thought experiment.

4. Time travel with decision entanglement

Let us consider the following two scenarios in a thought experiment:

1.Scenario

At 15:55, Max told me:

'I have just invented a time machine. Do you want to see it?'

Of course, I accepted. At 15:58, Max and I entered the room where the machine was. It looked like a simple metal chair. The machinery seemed to be located under the seat.

At 15:59, while Max and I looked at the machine from the room's door, a second exact copy of it suddenly appeared, just near the first machine. In the second machine was seated an exact copy of Max. Amazed, Max and I looked at this.

At 16:00, the original Max crossed the room, sat on the original machine, pressed a control and disappeared towards the future. The copy of Max, still sitting on the copy of the machine, observed attentively what he was doing.

At 16:01, the copy of Max pressed a control in the copy of the machine and disappeared towards the future. Max and the machine never returned.

After thinking for some time, I imagined what had happened. At 16:00, the original Max travelled to the future in the original time machine, but when he arrived he travelled back to the past, arriving at 15:59. After looking at the original Max leave on the original time machine at 16:00, he went again to the future at 16:01 and never came back.

2. Scenario

At 15:55, Max told me:

'I have just invented a time machine. Do you want to see it?'

Of course, I accepted. At 15:58, Max and I entered the room where the machine was. It looked like a simple metal chair. The machinery seemed to be located under the seat.

At 15:59, while Max and I looked at the machine from the room's door, a second exact copy of it suddenly appeared, just near the first machine. In the second machine was seated an exact copy of Max. Amazed, Max and I looked at this.

At 16:00, the copy of Max stood up, went to the original machine, sat on it, pressed a control and disappeared towards the future. The original Max, near me, observed attentively what he was doing.

At 16:01, the original Max crossed the room, sat on the copy of the machine, pressed a control and disappeared towards the future. Max and the machine never returned.

In this scenario, what had happened was this: at 16:01, the original Max travelled to the future in the second time machine. When he arrived, he found the first time machine and the second Max awaiting for him there. He changed machines and travelled back to the past, arriving at 15:59. After changing machines again, he travelled to the future on the original time machine at 16:00 and never came back.

Figure 1 displays the graphical solution to both scenarios in the thought experiment. It can be seen that, in the second scenario, the time traveler must change time machines in the future, as he did in the past. Otherwise (as shown in figure 2) the

situation would become inconsistent, with a copy of the time traveler appearing without a cause and living just during a temporal loop. Something similar would happen if the time traveler changed machines in the future during the first scenario, only in that case it would be a copy of the machine that would appear without a cause and remain existent only during a time loop.

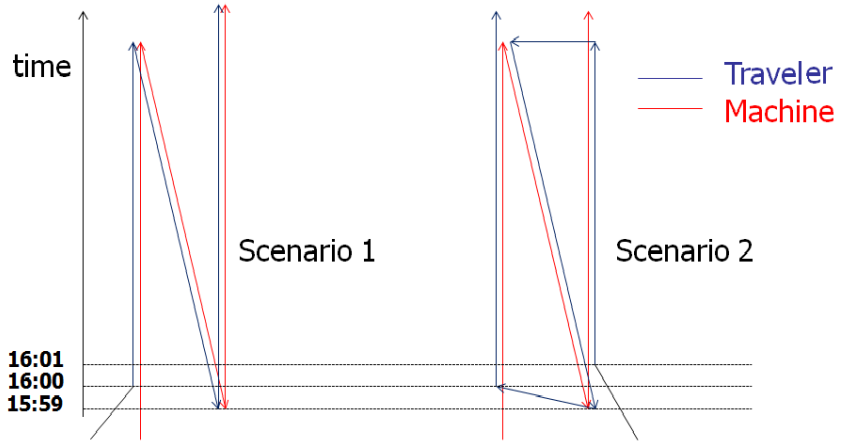


Figure 1: What happened in both time-travelling scenarios.

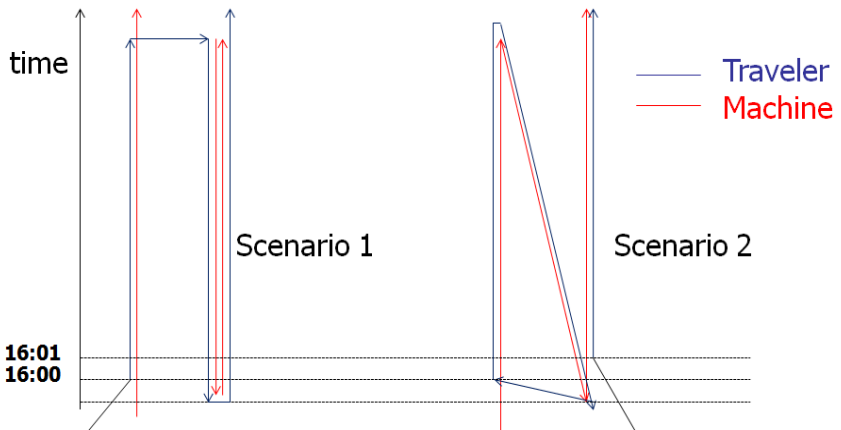


Figure 2: Inconsistent solutions for both time-travelling scenarios.

This has surprising consequences: the behaviors of the time traveler during the present and the future are entangled. If Max changes machines in the present, he must change machines in the future; if he doesn't, he mustn't. What this means is, the time traveler is not free to act in so simple a matter as changing seats or not, for his future behavior is determined by his present behavior.

We believe this thought experiment shows that, in the context of the block universe, there are—at least it does not seem to be a-priori impossible that there are— events (decisions by supposedly free agents) which are not just coordinated with (and partially co-determined by) the rest of the world in a general way, but which depend specially and strongly on another event (e.g. another apparently free decision) in a different moment of the subject's history.

This is not what could be expected in Hoefler's context of freedom in the block universe. Let us consider, for instance, the following paragraph by Hoefler:

'If we shake loose from the tendency to see the past as special, when it comes to the relationships of determinism, it may prove possible to think of a deterministic world as one in which each part bears a determining—or partial-determining— relation to other parts, but in which no particular part (i.e., region of space-time) has a special, stronger determining role than any other.'⁹

Of course, our thought experiment does not prove that a particular region of space time (the past, for instance) has a special determinant role, but it shows that a particular event, in the context of the block universe, could 'co-determine' a decision in a strangely strong way.

Can we argue that this strange ligature is compatible with the adoption of a free decision at times linked in this way? It's hard to believe. To realize the difficulty, consider again the core of Hoefler's proposal.

9) Carl Hoefler, "Causal Determinism", in *The Stanford Encyclopedia of Philosophy*, (Spring 2016 Edition), ed. Edward Zalta, URL: <http://plato.stanford.edu/archives/spr2016/entries/determinism-causal/>. (Last time consulted March 2016).

That core could be summarized by stating that determinism simply provides a logical co-implication network between all the events in the block universe, whereby all states of the universe jointly entail one another. But this co-implication network does not involve a causal priority of some parts over other parts. And so, according to Hoefer, because determinism is completely silent on the causal priority of one state of the universe over another, it is compatible with determinism that our choices are causal prior to our actions.¹⁰

However, if we consider the process by which Max takes his decisions in each of the critical points in the example we have been considering, it is not easy to conceive in what sense could be argued that in the two interlaced decision points Max's mental deliberation has the causal priority over his decisions.

In other words, the interesting thing about the situation we are analyzing in this section is this: in the case of any decision whatever taken in the block universe, the constraints affecting the decision are presented, in principle, in a somewhat diffuse form. Of course, we accept that everything co-determines everything else, but as this is a general statement, we can consider the deliberative process at a point in time as a factor in the process of co-determination. Then we can, with Hoefer, try to establish our freedom of choice in the co-causal power of our deliberations. But in the case of Max's time-travels, we have two deliberative processes, not just constrained in a general way by the rest of the block universe, but each of them entirely determined by the other, despite the fact that, if we consider them as individual deliberative processes, the decision taken in one of the processes need not play a role in the deliberative thoughts that eventually will lead to the other decision. If this is so, how can we say that those thoughts are the causal key of the decision?

10) Hoefer strengthens this point by appealing to downward causation: mental states can downwardly cause physical states. Therefore, as the deterministic network tells us nothing about causal priorities, we are entitled to consider that the causes of our actions, regardless of the network of logical constraints, are our conscious decisions.

Even more: since the strongly entangled decisions in this strange set of pairs are not, in principle, different to those other decisions not so entangled, the doubt about what is the meaning of *freedom of decision* in the context of the block universe spreads beyond the particular cases of correlations like those we have considered in the previous thought experiment. If the freedom of some decisions becomes doubtful, the freedom of every apparently similar decision also becomes doubtful.

And the worst is, if the elimination of the presentist intuition (such as the priority of the past) cannot guarantee a concept of freedom related to what is usually considered a free decision, this insufficiency could also fall on Nahin's analysis of the *grandfather paradox*. Would it be enough, to guarantee freedom in those situations, to remind us that, in the context of the block universe, the event line (and therefore the decision line) exists a-temporally? How does this argument affect the possible existence, in the context of the classic paradoxes, of strongly correlated decisions, in the way described in the thought experiment we have formulated? Can we speak of freedom with such correlations?

5. Tentative conclusion

To finish this discussion, we'll pose the following question: From a simple exercise of thought, such as the one we have just made, is it actually possible to deduce something useful for the discussion about the compatibility of free-will with the block universe?

Of course, the following objection could be made: even if we accept the block universe hypothesis, it is possible that time machines cannot exist, therefore scenarios as those described here would not be possible. Recent results such as Manchak¹¹ suggest that there are relativistic space-times that make the operation of time machines possible, but our universe probably does not comply with the required conditions, or, if it complies with

11) John Byron Manchak, "On the Existence of 'Time Machines' in General Relativity" *Philosophy of Science*, 76 (2009): 1020-1026.

them, it could be that they are incompatible with structures such as living beings.

But we believe that this point is not really decisive. To generate entangled decisions such as those described here, it is not necessary that time travel be a fact. In principle, it would be enough if there are closed time-like curves (CTC) without human operation in space-time. Up to now, no one has found a result that excludes this scenario in a relativistic block universe, as ours could be.

Therefore, asserting that a happy physical combination will always prevent, in the block universe, the possible arising of situations that make freedom of decision dubious, would not be an approach more plausible than insisting that the time traveler will always find obstacles to make decisions that would lead to inconsistencies.

In conclusion, we believe that the compatibility of the block universe with freedom in human actions is still at least doubtful, in spite of the recent attempts to show otherwise, which we have mentioned in this paper, for the consistency of the different events in a block universe could set constrictions impossible to accept, starting from a minimally intelligible concept of free-will.

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