to appear in Portuguese Journal of Philosophy
(Revista Portuguesa de Filosofia) [Special Issue on Metaphysics]

Why Time Travellers (Still) Cannot Change the Past

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1 Introduction

In an earlier paper I presented the following argument to the conclusion that time travellers cannot change the past:[1]

> It is widely believed that if backward time travel were possible, one could go back in time and, with the benefit of foresight, prevent one's past mistakes and the terrible events of history. One could kill Adolf Hitler when he was young, urge Ned Kelly to cover his knees, and so on. Sadly, this idea is incoherent—I call it the *second-time-around fallacy*. There can be no first time around of a set of events, with the time traveller absent, followed by a second time around of the *very same events*, with the time traveller playing a role: for either there is no second time around; or else the second time around is a genuinely distinct series of events, to be involved in which is to *avoid* rather than *change* the original series of events. To see this, consider that to say that an event (for example, Australia losing the America's Cup in 1987) both did and did not occur, simpliciter, is to assert a contradiction. To be able to say without contradiction that some event both did and did not occur, one must posit at least two times or places such that the event occurred at one, but not at the other. Suppose that times are multiplied. One might posit two temporal dimensions, saying that time is like a plane rather than a line. Then the year 1987, for example, is a line across the plane, and the time traveller can travel to a point

[1] SMITH, NICHOLAS J.J. – "Bananas Enough for Time Travel?". *British Journal for the Philosophy of Science*. Vol. 48 (1997) p.363–89.

> on that line (1987 at hyper-time *b*) at which she prevents the Americans from winning back the America's Cup. She cannot, however, prevent the very loss which she witnessed as a young woman: at the point on the 1987 line which the time traveller experienced as a young woman (1987 at hyper-time *a*) Australia loses. Suppose, then, that places are multiplied. One might posit universes parallel to our own. In this case the time traveller can travel to a universe in which she sabotages *Stars and Stripes*. Once again, however, she cannot prevent the loss she witnessed before departing: in the universe from which she departs, Australia loses in 1987. So the idea that time travellers can change the past is incoherent. If there is no bifurcation, of time or place, then there can only be contradiction, not change. Yet even if there *is* such bifurcation, still there can be no change, only *avoidance*: in this case what the time traveller causes to happen is *not* what she wanted to happen (she wanted *Adolf Hitler* to die, say—she did not want some analogue of Adolf Hitler in another universe or temporal dimension to die).
>
> ...if there are parallel universes, or additional temporal dimensions, then time travellers can *avoid* the past. They can *change* the past, however, no more than anyone can do anything contradictory, such as prove that 17=7.[2]

For the sake of convenience, let us refer to this as the Avoidance argument.[3]

Goddu (2003) presents a hypertime model in which, he claims, time travellers can change the past.[4] According to the Avoidance argument, such a model can only involve time travellers avoiding the past—not changing it. Goddu (2011) responds to the Avoidance argument and maintains that his model involves time travellers changing, not avoiding the past.[5]

The present paper proceeds as follows. In §2 I discuss Goddu's reconstruction of the Avoidance argument, point out some problems with that reconstruction, and clarify the position that the Avoidance argument is intended to

[2]Smith (1997) p.365–366.

[3]As we shall see in §2, Goddu uses the term 'Avoidance Argument' to refer to a somewhat different argument. Except when quoting Goddu, I shall always use the term 'Avoidance argument' to refer to the argument in Smith (1997) p.365–366 quoted above.

[4]GODDU, G.C. – "Time travel and changing the past (or how to kill yourself and live to tell the tale)". *Ratio*. Vol. 16 (2003) p.16–32.

[5]GODDU, G.C. – "Avoiding or changing the past?". *Pacific Philosophical Quarterly*. Vol. 92 (2011) p.11–17.

support. In §3 I discuss what would be required to substantiate the claim that a given model involves changing rather than avoiding the past. In §4 I consider Goddu's hypertime model and an earlier model due to Meiland (1974).[6] Both Meiland and Goddu claim that their models allow for time travellers to change the past. I show that while both models are coherent, neither author does what would be required to substantiate the claim that the model involves changing (not avoiding) the past. In §5 I go on to give reasons for the stronger claim that no-one *can* present a coherent model and also substantiate the claim that it involves changing (not avoiding) the past—and hence the conclusion of the Avoidance argument stands.

2 The Avoidance Argument

Goddu writes:

> Smith's argument is an example of what I call the Avoidance Argument, viz.
>
> (P1) For any event E that a model purports to represent as changing, either the model bifurcates the time (or place) of E or it does not.
>
> (P2) If the model bifurcates the time (or place) of E, the model represents avoiding E rather than changing E.
>
> (P3) If the model does not bifurcate the time (or place) of E, the model is contradictory.
>
> (C) Hence, no model consistently represents changing E.
>
> As it stands, the avoidance argument is not specifically about changing the past. Rather it is about the possibility of changing events *simpliciter*. Regardless, if no events can be changed, then no past events can be changed and the past cannot be changed. For ease of expression, I shall continue to use the Avoidance Argument that applies to all events. Those who see a significant difference between past events and present or future events should just read 'event E' in the Avoidance Argument as 'past event E'.[7]

[6] MEILAND, Jack W. – "A two-dimensional passage model of time for time travel". *Philosophical Studies*. Vol. 26 (1974) p.153–173.

[7] Goddu (2011) p.12.

I do not endorse this argument—and the problem does not turn on the consideration of all events as opposed to just past events. Intuitively events *can* change (and they can be changed by the actions of individuals). For example, a sporting event might change from being one sided to being a nail biter—or a meeting might change from antagonistic and unconstructive to positive and fruitful (perhaps as a result of someone's giving a compelling speech). Such changes involve an event that is spread across time changing from being one way at some earlier time to another way at some later time. (The sporting event is one sided in the first half and a nail biter at the end; the meeting is initially antagonistic and unconstructive but later becomes positive and fruitful.) I have no objection to this ordinary conception of an event changing over time (while remaining the same event).

My argument is against the idea that an event might change from being one way *at a certain time t* to being another way *at that same time t*—or to put it another way, against the idea that it is possible for things to change so that instead of E happening (or not happening) at some time t, E does not happen (or does happen) *at that very time t*. This is *not* the sort of change involved in the above examples of the meeting and the sporting event—but it is the kind of change involved in many time travel scenarios (for example, a scenario in which a time traveller intervenes in such a way that World War Two ends in 1942 instead of 1945, thus saving many lives—or a scenario in which a time traveller informs her younger self at age eighteen of something she did not know when she was eighteen but wishes she had known—say, the dangers of smoking).

Given that I do not endorse Goddu's argument, coming up with a counterexample to that argument—say, the example of the meeting, which changes over time while remaining the same meeting—is not enough to answer my original Avoidance argument. However this point need not detain us, because the hypertime model that Goddu proposes would—if successful—show that my original argument was mistaken. That is, the model would involve an event changing from being one way at some time t to being a different way at that very same time t. So let us move on.

3 Two Tasks

What Goddu—and Meiland before him—attempt to do is provide a coherent model of changing the past: a model in which an event changes from being one way at a time t to being a different way at the same time t—or in which a time t changes from being such that some event occurs at t to being such that the event does not occur at t (or vice versa). Both authors accept that in order to be coherent, such models must involve a bifurcation: there must be two versions of the time t, or else we simply have a contradiction when we say that t both is and is not such that some event E occurs at t. They both also posit the same *kind* of bifurcation: both their models involve a second time dimension—'hypertime'[8]—such that a single normal time (1066, 18 September 1970, noon Greenwich Mean Time on New Year's Day 2015, and so on) can occur at multiple different hypertimes.

Now positing a new set of indices—whether hypertimes, or parallel universes, or something else—such that to fully specify the 'position' of an event, we have to give not only its normal time (and spatial location) but also another index—for example, 1066 at hypertime a, or 1066 at hypertime b—*opens the way* to a consistent model in which normal times, or the events occurring at them, have incompatible properties: one property can be had by that normal time relative to one of the new indices, while the other property is had by that normal time relative to another of the new indices. However, *just* positing hypertime or some other new set of indices is not the end of the story: more work needs to be done before we have a coherent model of changing the past.

To see this, forget about hypertime for a moment and compare the situation with (normal) change (of normal everyday objects) over (normal) time. In a nutshell, the problem of change is as follows. Suppose an object changes from being P to being not P (or vice versa). So we have an object that is P and an object that is not P. Now if they are the very same object then this is a contradiction: we are saying that the object is both P and not P. But if they are different objects then we do not have *change*: instead of one object changing from possessing P to lacking P we just have two different objects, one of which possesses P and one of which lacks P. Now if we posit time

[8]Goddu uses this term. Meiland speaks of two time dimensions but does not use the term 'hypertime' for one of them. Nevertheless I shall sometimes, for the sake of convenience, use the term 'hypertime' when discussing Meiland's view (but never in such a way that my argument turns on the use of this particular term).

we potentially open the way to a solution to this problem: but we do not, *simply* by positing time, *solve* the problem. With time in the picture we open the way to saying that while there is a contradiction in an object possessing P and not possessing P (simpliciter), there is no contradiction in an object possessing P at time t_1 and not possessing P at another time t_2. However, this is just the beginning of a solution to the problem of change. We still need a substantive account of *how* the very same object can persist from t_1 to t_2 while possessing different properties at (or relative to) these two times. Many different substantive accounts have been proposed. For a taste of some positions in the area—without any pretence at a comprehensive survey—consider the following views.

Three-dimensionalism is the view that persons, tables and other material objects are three-dimensional entities. On this view, what you see in the mirror is a whole person.[9] Tomorrow, when you look again, you will see the whole person again. On this view, persons and other temporal objects are *wholly present* at every time at which they exist. *Four-dimensionalism* is the view that persons, tables and other material objects are four-dimensional entities, extending through three dimensions of space and one dimension of time. On this view, what you see in the mirror is not a whole person: it is just a three-dimensional temporal part of a person. Tomorrow, when you look again, you will see a different such temporal part. Say that an object *persists* through time if it is around at some time and still around at a later time. Three- and four-dimensionalists agree that (some) objects persist, but they differ over how objects persist. According to three-dimensionalists, objects persist by *enduring*: an object persists from t_1 to t_2 by being wholly present at t_1 and t_2 and every instant in between. According to four-dimensionalists, objects persist by *perduring*: an object persists from t_1 to t_2 by having temporal parts at t_1 and t_2 and every instant in between. Perduring can be usefully compared with being extended in space: a road extends from Melbourne to Sydney not by being wholly located at every point in between but by having a spatial part at every point in between.

Leibniz's Law says that if $x = y$ (i.e. x and y are identical—one and the same entity) then x and y have exactly the same properties. There is a superficial conflict between this principle of logic and the fact that things change. If

[9] I don't mean that the *front side*—the side you can see in the mirror—is all there is to the person. I mean that standing there, before the mirror, is the entire person.

Bill is at one time thin and at another time not so—and yet it is the very same person both times—it looks as though the very same entity (Bill) both possesses and fails to possess the property of being thin. Three-dimensionalists and four-dimensionalists respond to this problem in different ways. According to the four-dimensionalist, what is thin is not Bill (who is a four-dimensional entity) but certain temporal parts of Bill; and what is not thin are *other* temporal parts of Bill. So there is no single entity that both possesses and fails to possess the property of being thin. Three-dimensionalists have several options. One is to deny that there are such properties as 'thin' (simpliciter): there are only temporally relativised properties such as 'thin at time t'. In that case, while Bill at t_1 and Bill at t_2 are the very same entity—Bill is wholly present at each time—there is no single property that this one entity both possesses and fails to possess: Bill possesses the property 'thin at t_1' and lacks the property 'thin at t_2'.[10]

On any view in this area, the question of *diachronic identity conditions*—the question whether and why some object at t_2 is or is not the same object as some object at t_1—is a substantive one.[11] For example, suppose that at t_1 there are two books on the shelf: one red and one dark blue. At t_2 there are two books on the shelf: one orange and one light blue. Is the red book at t_1 the same book as the orange book at t_2, or the light blue book, or neither? We cannot just claim whatever we like here: the answer depends on the causal relations between the various objects. If the red book just sat there and was faded by the sun until it became orange, then we will want to say that the red book is the same as the orange book; if the red book was removed, re-bound in light blue cloth and then returned to the shelf, then we will want to say that it is the same book as the light blue one; and so on. There are notorious puzzle cases in this area—the Ship of Theseus; puzzles of personal identity involving teletransportation, fission or fusion; and so on—that make the task of giving diachronic identity conditions for particular kinds of objects very difficult.

[10] Another option is adverbialism. On this view, there are indeed properties such as 'thin' (simpliciter)—but there is no such thing as 'having a property' (simpliciter). Rather, objects have properties $t$ly. Thus, Bill has the property 'thin' $t_1$ly and does not have it $t_2$ly—so again, contradiction is avoided.

[11] In three-dimensionalist terms, the question is whether the objects are literally identical. In four-dimensionalist terms, the question is whether the four-dimensional object we pick out by pointing at a certain three-dimensional temporal part at t_1 is the same as the four-dimensional object we pick out by pointing at a certain three-dimensional temporal part at t_2 (cf. crossing a road and then later crossing another road: the question might arise whether we crossed the same road twice—at different points—or crossed two different roads).

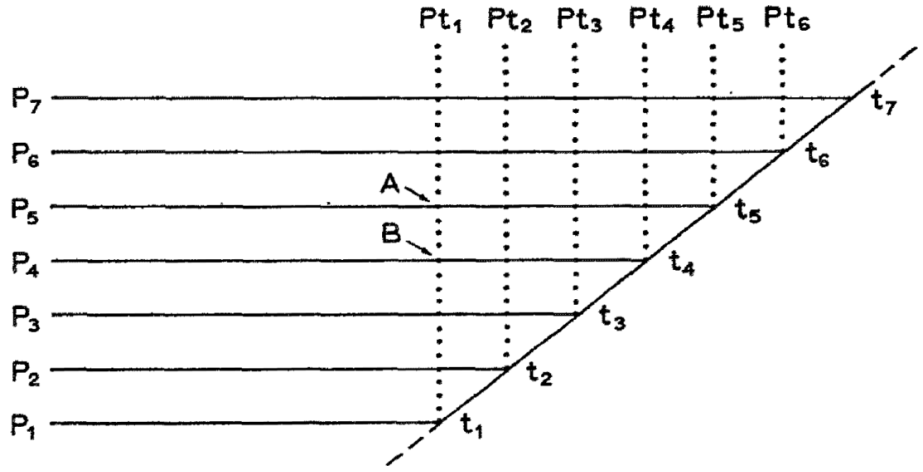
Returning to the case of hypertime and changing the past, the lesson is as follows. To give a coherent model of changing the past, positing hypertime is not enough. Two further tasks must also be completed. Task One is to give the general format of the account: we need to specify in what kind of way a normal time is supposed to persist across hypertime. For example, does this happen in something like a perdurantist or an endurantist way? Meiland seems to have in mind some sort of endurantist picture: he notes that when he says that different times have different pasts associated with them, he means pasts that are numerically the same but qualitatively different.[12] Goddu seems to have in mind a perdurantist picture: he talks of objects, events and moments of time being hypertemporally extended and having hypertemporal parts.[13] Neither author gives a fully explicit discussion of this issue—but let us move on: the real problem is the next task.

Task Two is to flesh out the general format with substantive content. Specifically, we need to give substantive content to the claim that some normal time t_1 at hypertime a and some normal time t_2 at hypertime b are or are not (hypertemporal parts of) the same normal time. It is not good enough simply to *claim* that t_1 at hypertime a is (or is not) the same time as t_2 at hypertime b: we need some substantive account of what would *make it the case* that t_1 at hypertime a is (or is not) the same time as t_2 at hypertime b. We need a substantive answer to the question as to what the difference is between a case where t_1 at hypertime a *is* the same time as t_2 at hypertime b, and a case where t_3 at hypertime c is *not* the same time as t_4 at hypertime d. That is, we need some account of the dia*hyper*chronic identity conditions of (normal) times (and similarly of the events that occur at these times). (Recall: in the ordinary case of persistence over time, we cannot just claim that book B at time t_2 is the same as book A at time t_1 and book C at time t_3 is not the same as book A at time t_1: we need a substantive account of what would make such claims true. We do not solve the problem of how a book can change from being red to orange just by positing times—we also need a substantive account of the diachronic identity conditions for books.) It is here that Meiland and Goddu fall down—as we shall see in §4. In §5 I shall furthermore argue that it is hard to see how anyone *could* complete Task Two.

[12] Meiland (1974) p.160.
[13] Goddu (2011) p.17, n.8.

4 Meiland and Goddu on Task Two

Meiland introduces his hypertime model via a diagram:[14]



He then writes:

> Here we have a multi-dimensional theory of time—in particular, a two-dimensional theory—as compared with the usual one-dimensional theory which represents time along a straight line. The moments labelled t_1 to t_7 on the diagonal line are present moments. The line P_1–t_1 (which we can call 'P_1' for short) represents the past when t_1 is the present moment. That is, P_1 is the past at (or with respect to) the present moment t_1. Similarly, P_2 is the past with respect to t_2. The dotted vertical lines indicate the positions of moments in the past. For example, the intersection of P_3 with vertical line Pt_1 is the position of the moment t_1 in the past with respect to t_3. In this example, t_3 is the present moment and the intersection of the two lines just mentioned is the position of t_1 when t_1 is past with respect to t_3.[15]

Meiland then claims that his model "allows the past to change",[16] giving the following example, in which Harrison (allegedly) changes the past from being such that he was not at the Great Exhibition to being such that he was:

> we can deal with Harrison's trip to the Great Exhibition in the following way. Consider the present moment t_4 in [the diagram]. P_4

[14] Meiland (1974) p.158.
[15] Meiland (1974) p.159.
[16] Meiland (1974) p.160.

> is the past associated with t_4. Now, suppose that t_1 is the time of the Great Exhibition (1851, that is). So the point in [the diagram] labelled 'B' is the time of the Great Exhibition in t_4's past. Suppose further that Harrison is not at B. But between t_4 and t_5, someone invents a time machine which Harrison enters at t_5 and travels to the Great Exhibition. If time travel into the past takes no time (that is, is instantaneous), then Harrison will arrive at the point labelled 'A'. Thus, the proposition 'Harrison was not at the Great Exhibition' is true at t_4 and false at t_5. In other words, our model of time allows propositions about the past to change their truth-value—because it allows the past to change.[17]

It is absolutely crucial here that it is the *same time* t_1 on lines P_4 and P_5. That is, points A and B must both be time t_1 (in this case 1851) or else Harrison has not changed *that time* (he has just avoided the past, not changed it). Now consider Task Two. Meiland says nothing at all to substantiate the claim that it is the same time t_1 at points A and B. He simply claims that they are the same time. But what can this mean? We need some substantive account—but we do not get one. We need an account of what would make it the case that two points on his diagram represent the same time and what would make it the case that two points on his diagram represent different times. We need, that is, some account of the dia*hyper*chronic identity conditions of (normal) times. We get no such account. But without one, we do *not* have a coherent model of the past changing. We have no reason at all to regard the model as one in which there is a single time 1851 that changes across hypertime, as opposed to one in which there are multiple distinct times variously called '1851' that differ in various ways—in which case Harrison does not change the time that he originally refers to as 1851: he simply avoids it.

Meiland, then, seems not to realise the importance of Task Two. He would appear to be in the same sort of position as someone who thinks that one can solve the problem of change just by positing time—without giving any substantive theory of diachronic identity conditions. Let's now turn to Goddu. As we shall see, he is more aware of the importance of Task Two—but still fails to complete it in a satisfactory manner.

Goddu first presents his hypertime model in his 2003 paper, via an analogy with a video cassette recorder (VCR):

[17] Meiland (1974) p.159–160.

> Is there a way of coherently modeling a universe in which the past changes? I think there is. Consider first a standard video cassette recorder and monitor set up. The VCR has a clock that displays normal, everyday time—call this time 'clock-time'. The monitor, on the other hand, displays how much time has elapsed on the video cassette being viewed—call this time 'cassette-time'. ...suppose the clock reads 16:00:00 and the monitor, 0:00:00. Now let a cassette play the first twenty minutes of the Star Trek episode, 'City on the Edge of Forever'. At the end of twenty minutes the clock reads 16:20:00 and the monitor displays 00:20:00. Now let the cassette be rewound for fifteen (clock-time) seconds until the monitor display reads 0:05:00. The clock now reads 16:20:15. Now let the cassette record twenty minutes of the episode, 'Yesterday's Enterprise.' When the cassette stops after twenty minutes the clock reads 16:40:15 and the display reads 0:25:00. The interval between 0:05:00 and 0:20:00 has occurred twice, though at different clock-times. The images and sounds on the cassette during that interval are now different from what they once were. Before 16:20:15 the cassette-time interval between 0:05:00 and 0:20:00 contained parts of 'The City on the Edge of Forever', but by 16:35:15 that same temporal interval contains parts of 'Yesterday's Enterprise'. The content of the cassette has been changed.
>
> The VCR and monitor set up provides one conceptual basis for understanding time travel in a universe in which temporal moments have hypertemporal parts. Consider then a hypothetical universe that has two temporal dimensions related much like clock-time and cassette-time are related. Let the images and sounds on the cassette over a particular interval be analogues of the events of the world over a particular interval. Since the intervals on the cassette are measured in cassette-time, cassette-time will be an analogue of the time we live in; call this 'normal time'. Clock-time is then an analogue of hypertime.[18]

There is a serious problem here. The VCR analogy provides no conceptual basis for understanding a model with two kinds of time because, contrary to first

[18] Goddu (2003) p.21–22.

appearances, the VCR case does *not* involve two kinds of time. It is simply a model in which a *spatially* extended object—a video tape—changes over (normal) time. 'Cassette time' is not a temporal measure at all: it is a measure of distance along the tape. It is simply convenient, in the circumstances, to measure off distance along the tape according to how long it would take to get to a certain position on the tape were the tape played or recorded at normal speed. Just because it uses terminology normally used to measure temporal intervals, this does not make cassette time a temporal measure—no more than 'light year' is a measure of time (it is a measure of spatial distance). The VCR case is just a perfectly mundane case of a spatially extended object changing over time—like a fence (or section thereof) being painted one colour and then later repainted. Now suppose my bus runs to a very regular schedule and travels past this fence. I may therefore decide to label sections of the fence using terms normally used to refer to times: the 8:00:00 to 8:00:30 section, and so on. Even so, this still doesn't make the fence repainting scenario a model of *time* changing over time—when I say that 8:00:00 to 8:00:30 changes, I just mean that a certain spatial part of the fence changes—and the VCR model is no better than the fence model as a conceptual basis for understanding how times could change over time.

In his 2011 paper, Goddu directly addresses the worry that his model, by bifurcating times, involves avoiding not changing the past. However, as we shall now see, his argument contains a series of unwarranted assumptions and ultimately fails as an attempt at Task Two. Goddu begins:

> Suppose events are individuated in terms of the locations and times at which the events take place such that happenings at different locations or different times are distinct events. Surely some such assumption is underpinning Smith's claims... concerning bifurcation of time or place resulting in a 'genuinely distinct series of events'.[19]

After writing here of events being individuated by locations and times, Goddu immediately goes on to talk of "the times that individuate events".[20] In any case, I do not assume that events are individuated by times, or by times and locations—and indeed I think this view is pretty clearly false. Events can be moved and postponed without becoming different events—and two distinct events can occur at the same place and time.

[19]Goddu (2011) p.13.
[20]Goddu (2011) p.13.

Moving on, Goddu presents the VCR example again—and then writes:[21]

> No portion of the tape occurs at more than one period of elapsed-tape-time, so there is no bifurcation of the times that individuate different portions of the tape. Different portions of the tape exist, can be played, and have different properties at multiple clock-times, so there is some bifurcation of the time of a given portion of the tape. Hence, not all bifurcations of time need be bifurcations that individuate. As a result, we can describe portions of the tape changing without contradiction because the different times at which the particular portion of the tape is one way and then another are not themselves elapsed-tape times.[22]

The idea here is that portions of the tape are individuated by elapsed tape time—and hence we can have the same portion of tape occurring at different clock times. But as I have already pointed out, 'elapsed tape time' is a measure of spatial distance along the tape—it is not a temporal measure at all. All we have here is an ordinary example of a spatially extended object changing over time. The VCR analogy therefore gives us no basis for understanding how a period of time could change over time—and hence Goddu is quite unwarranted to continue as follows:

> Now consider a more exotic possibility. Suppose that just as elapsed-tape-time is embedded in clock-time, clock-time itself is embedded in some higher order time. For ease of presentation call the time in which clock- or normal-time is embedded, 'hypertime'. So just as the period of the tape from 0.05.00 through 0.15.00 could be played at different clock-times, so could different periods of normal-time and the events of those times occur at different hypertimes. The result would be that, just as objects can exist at more than one time and so be one way at one time and another way at some other, moments of time or the events of moments of time can also exist at more than one hypertime.[23]

There is no "just as" here—because (as already remarked) the VCR example involves a *spatially* located (or extended) point (or section) of tape changing

[21] Note that the term 'elapsed-tape-time' is now used in place of the earlier term 'cassette-time'.

[22] Goddu (2011) p.13–14.

[23] Goddu (2011) p.14.

over time—whereas the hypertime case is supposed to involve a *temporally* located (or extended) point (or interval) changing over a second temporal dimension.

Goddu now makes another unargued assumption: "Assuming that events are individuated by the normal-times at which they occur".[24] Earlier there was an assumption (which I already rejected) that events are individuated by times—now the further assumption is made that, out of normal times and hypertimes, it is normal times that individuate events. On the basis of this assumption, Goddu then goes on to present a time travel scenario and conclude by describing it as follows:

> The events of 1928 occur at only one normal-time, viz. 1928, so there is no bifurcation of the event-individuating times of the events of 1928. Regardless, Jack consistently changes the events of 1928 by making the hypertemporally most recent part of the constituents of the events of 1928 differ from previous hyper-temporal parts of the constituents of the events of 1928.[25]

Here there is an even more crucial—and entirely unargued—assumption. The assumption is that "1928" at hypertime *a* and "1928" at hypertime *b* really are one and the same normal time. Even if we accept the earlier assumption that events are individuated by normal times, we cannot conclude that Jack changes (rather than avoids) the events of 1928 unless we know that the "1928" he travels to is the same normal time as the original "1928". But this cannot simply be stipulated. The whole point of Task Two is that we need a substantive account of what makes it the case that "1928" at hypertime *b is* the same time as "1928" at hypertime *a* and of what makes it the case that "1929" at hypertime *b* is *not* the same time as "1928" at hypertime *a*. Goddu gives no such account. The only thing he gives in support of the idea that "1928" at hypertime *b* is the same time as "1928" at hypertime *a* is the VCR analogy. As I have shown, this analogy fails. Hence Goddu does not carry out Task Two. Ultimately he gives us no more reason than Meiland does to think that we have a model in which there is a single past that changes—as opposed to multiple pasts, one of which is avoided in favour of another.

[24] Goddu (2011) p.14.
[25] Goddu (2011) p.15.

5 Reasons to Think Task Two Insurmountable

The project shared by Meiland and Goddu is to make sense of the idea that the past could change, by giving a model in which there are two temporal dimensions: normal time and hypertime. In order to make good on this project, one must give substantive content to the idea that the *same* normal time occurs at multiple different hypertimes. Task One was to specify whether 'same' here is to be understood in a perdurantist kind of way or an endurantist kind of way (or perhaps some other kind of way). Task Two is to specify what kinds of relations are required between normal time t_1 at hypertime a and normal time t_2 at hypertime b in order for it to be the case that t_1 and t_2 are, or are not, the same time. We need a substantive account of what would make it the case that they are, or are not, the same normal times. It is not good enough simply to present a certain scenario and just claim that "1928" (or "1851" or whatever) at hypertime a and "1928" at hypertime b are the same normal time. We need an account of the conditions under which such a claim would be true and the conditions under which it would be false. Just as in the ordinary case of change we need diachronic identity conditions for spatially extended objects, here we need dia*hyper*chronic identity conditions for normal time instants and periods of normal time and for the events located at these normal times.

Here there is a serious obstacle. Consider identity of objects over normal time (with no hypertime in the picture). The reason we want to say that book B at time t_2 is the same as book A at time t_1 and book C at time t_3 is not the same as book A at time t_1 is that how book B is depends in a particular kind of way on how book A was and how book C is does not. Presumably, then, in the hypertime case, the basis for claiming that normal time t_1 at hypertime a and normal time t_2 at hypertime b are the same time is that how t_2 is at hypertime b depends in a particular kind of way on how t_1 is at hypertime a. So we need casual dependence across hypertime. But this then clashes with causal dependence across normal time. For Meiland and Goddu also want to say that how things are in 2015 at hypertime b depend on how they are at earlier normal times in hypertime b: the actions of the time traveller in the past have repercussions that flow on through normal time; and objects persist through normal time in the usual kinds of ways. But now we face a problem rather similar to that faced by dualists in the philosophy of mind. If we have a full causal story about how the physical world is at a certain time in terms

of how it was at an earlier time then there is no room for non-physical causes to play a role. Similarly, if we have a full story about how normal time t is (at hypertime b) in terms of how things were earlier in normal time (at hypertime b) then there is no room for a story about how things are at normal time t (at hypertime b) depending on how things are at normal time s at hypertime a. But then we have no basis for claiming that s and t are the same normal time.

Consider an analogy. Imagine some two-dimensional creatures (flatlanders) living on the surface of a sheet of paper. Now imagine a stack of paper on your desk—from sheet 1 on the bottom to sheet 500 on top—with such creatures on each sheet. Imagine that they think of the pages lower down the stack as *past* and pages higher up the stack as *future*. They believe that causation works up the stack: how things are on higher sheets depends on how things are on lower sheets. Now you might think to yourself: I can change their past. My time (i.e. everyday, normal time) is like hypertime for the flatlanders. If I draw on sheet 3, creatures on higher sheets will have a different past from the one they had previously. Now this is all very well, but it depends on thinking of sheet 3 as the same sheet before and after you draw on it. Now you are entitled to do that, because what is on sheet 3 at 12pm depends on what was on sheet 3 at earlier times. But this is not the flatlander's picture, according to which what is on sheet 3 at 12pm depends on what is on sheets 1 and 2 at 12pm. You cannot simultaneously view causation in the way the flatlanders do (as working up the stack) *and* think of yourself as changing their past (by drawing on sheet 3, so that it is the very same sheet/time before and after you draw on it).

Similarly in the hypertime case. Meiland and Goddu want a model in which effects propagate forwards through normal time in the usual way and objects persist through normal time in the usual way. But this is incompatible with the kinds of view one would need to have about causal dependency to think that the same time can persist across hypertime. The former requires thinking: how t_1 is at hypertime b depends on how earlier normal times are at hypertime b and how earlier normal times are at hypertime b suffices for how t_1 is at hypertime b. The latter requires thinking: how t_1 is at hypertime b depends on how t_1 is at hypertime a and how t_1 is at hypertime a suffices for how t_1 is at hypertime b. These claims of causal dependence and sufficiency cannot all be true.

6 Conclusion

In order to have even the possibility of a coherent model of changing the past, one needs to posit an additional set of indices—so that a past time, say 1928, can be one way at index *a* and a different way at index *b*. Without additional indices, 'changing the past' simply involves a contradiction (1928 being one way and not being that way). So suppose one does posit additional indices: 'hypertimes', as we may call them (as far as the main points to be recounted below are concerned, the precise nature of the additional indices is immaterial). This move, in itself, is not enough to yield a model of changing the past. Now one needs to show that 1928a (i.e. 1928 at hypertime *a*) is the same time as 1928b (i.e. 1928 at hypertime *b*)—or else one has not modelled a certain past time (in this case 1928) *changing*: one has modelled two different times, one of which is a certain way and the other of which is a different way. Here we face the issue of dia*hyper*chronic identity conditions. One needs to give substance to the idea of the same normal time existing at multiple hypertimes. One cannot simply claim that 1928a and 1928b are the same normal time: one has to say what would make such a claim true. Neither Meiland nor Goddu successfully carry out this task. Furthermore, it seems that no-one else will be able to do any better. For 1928b can only be a later (in hypertime) version of the same time 1928a if how 1928b is depends on how 1928a is and how 1928a is suffices for how 1928b is. But this sort of causal dependence and sufficiency across hypertime is incompatible with normal causality over normal time—with how 1928b is depending on how 1927b is and how 1927b is sufficing for how 1928b is—and no-one who wants to talk of changing the past in time travel scenarios wants to give up normal causation in normal time: they want to say that the effects of the time traveller's actions in the past propagate forwards in normal time in the usual sort of way and that objects persist over normal time in the usual sort of way.

Thus the Avoidance argument stands. Alleged models of changing the past either fall into contradiction (if they do not posit an additional set of indices) or else involve avoiding the past, not changing it—because there is no prospect of successfully competing Task Two: of substantiating the claim that it is *the same time* 1928 at hypertimes *a* and *b*.[26]

[26]Thanks to the two anonymous referees for their helpful comments.