Presentists should believe in time-travel

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1. Presentism and four-dimensionalism

Do non-present things exist? Four-dimensionalists say that they do, and presentists say that they don't[1]. Four-dimensionalists believe that time is a fourth dimension, orthogonal to the three spatial dimensions. In the same way that things exist at other points in space, says the four-dimensionalist, we should accept that things exist at other points in time. Just as Shania Twain exists, but not here, John Denver exists, but not now. On the four-dimensionalist view, the universe is an existing space-time manifold, containing everything that has happened, everything that is happening and everything that will happen. It follows from the four-dimensionalist picture that there is no single time that can be non-indexically regarded as the present.

Presentists deny the analogy between time and the spatial dimensions, and insist that the only things that exist are the things that exist now. Shania Twain doesn't exist here, but she does exist. John Denver doesn't exist now, so he doesn't exist at all. The best that can be said about John Denver, according to the presentist, is that he did exist. There are those who say that presentism is vacuously true, those who say that it is obviously false, and those who say that presentists and four-dimensionalists are talking past each other[2]. We think that the disagreement between presentism and four-dimensionalism is both real and interesting, but we won't try to defend that view here. In fact, our purpose is to deny what has sometimes been taken to be a defining difference between the two views: their disagreement over the possibility of time-travel.

2. A common view about time-travel

A time traveler is one who takes a trip, starting at some time and arriving at some earlier or later time, where the duration of the trip is unequal to the difference between the arrival and departure times. So, if I leave here now, travel for an hour, and arrive somewhere a thousand years in the future, then I am a time traveler. Someone who goes to sleep and wakes up a thousand years later is not a time traveler,

although he may feel like one. Time travelers have personal experiences much like ours, except that the times that follow one after the other in their personal times are not all the times that follow one after the other in external time. (More on this later.)

Is time travel possible? Philosophers disagree. But the common view is that time travel is possible if the four-dimensional view of time is correct, but is not possible if presentism is true. We call this the common view because we know many people who subscribe to it, and because the four-dimensional framework tends to be assumed by those who defend the possibility of time-travel. The common view has been defended in print by William Godfrey-Smith, who says that 'the metaphysical picture which underlies time travel talk is that of the block universe, in which the world is conceived as extended in time as it is in space'[3].The common view also seems to be behind John Bigelow's claim that the absence of time-travel stories prior to the nineteenth century counts as evidence that everyone was a presentist until then (although Bigelow might just be saying that we needed to think in non-presentist terms before we could *realise* that time-travel is possible)[4].

We shall argue against the common view. We will focus upon a class of fairly straight-forward stories – stories which are commonly (and with good reason) regarded as time-travel stories, and which are commonly (and with good reason) regarded as compatible with four-dimensionalism. Our goal will be to show that *if* these stories really are compatible with four-dimensionalism, *and* presentism is at all plausible, *then* they are compatible with presentism too. It may be that there are other sorts of stories which can be correctly regarded as time-travel stories and which are not compatible with presentism, but we will not concern ourselves with those[5]. We'll be happy if we can show that the presentist should accept the possibility of at least *some* time-travel stories.

3. The Nowhere Argument for the common view

Why think that time-travel is incompatible with presentism? One might argue as follows. According to the four-dimensionalist, the past, present and future all exist. If you want to travel to the past or to the future, you have a destination. There is somewhere for you go. The past and future are there waiting, as it were, for the time traveler to pay them a visit. But this is not the case on the presentist model. On the presentist model, the past and future do not exist, so there is nowhere for the time

traveler to go. Traveling to Portland is possible, because Portland is right there waiting for you. But traveling to the Land of Oz is impossible, because there is no such place. Traveling to the past or future is more like traveling to the Land of Oz, if presentism is true. You can't travel to somewhere that doesn't exist, so, if presentism is true, you can't travel to other points in time. So presentism implies the impossibility of time-travel. Call this the Nowhere Argument[6].

The Nowhere Argument is not a good argument. If it were a good argument, then it would rule out not just the possibility of time-travel, but the ordinary passage of time as well. Consider what is about to happen to all of us. We are about to take a journey into the immediate future. Now it is over. If presentism is true, however, then the time that we just traveled to did not exist when we started the journey. We just traveled to a time that did not exist, and we are about to travel to a time that does not exist. If it were impossible to travel to times that do not exist, then we would not be able to make these journeys in time, and the ordinary passage of time from one moment to the next would be impossible. This would be a disastrous result for presentism. One way or another, the presentist has to account for the passage of time from one moment to the next. One way or another, the presentist has to make room for travel to non-existent times. As the Nowhere Argument rules this out, it proves too much. Assuming that presentism can get to the starting line, the Nowhere Argument must be a bad argument.

We think that the Nowhere Argument is probably at the heart of the common view that time travel and presentism are incompatible. (Although there is another relevant argument against the possibility of time travel – an argument from endurantism, rather than from presentism. This argument is the topic of section 9 below.) It may be, however, that defenders of the common view have a subtler version of the argument up their sleeves. Perhaps there is something in the presentist's story that allows her to say that the travel to non-existent times that occurs in ordinary passage is possible, but travel to times in the past or distant future is not. To show that this is not the case, we will now try to give a positive account of the possibility of presentist time travel. Our broad strategy will be to present David Lewis's defense of the possibility of four-dimensionalist time travel, and show how it can be translated into presentist terms[7]. We will tell a coherent time-travel story and explain its coherence in four-dimensionalist, and then in presentist, terms. If our presentist explanation works, then presentism and time-travel are compatible.

4. Jennifer's Journey

The year is 1985. You, Jennifer, are a glum, unmotivated fourteen year old. One day, as you sit in your black bedroom listening to Pink Floyd, a strange old woman appears, as if from nowhere. She is wearing a dressing gown and smoking a cigar. At first, she seems just as shocked at her sudden appearance as you are, but she quickly settles down and begins to chat. She seems to know a lot about you. She says that you have been miserable for too long, and it is time that you pulled yourself together and did something with your life. But not just anything. According to the strange old woman, you have an undiscovered talent for playing tennis, and with the right training you could be a world-class competitor. You are intrigued, and the two of you enter into a discussion. After an hour-long motivational talk, including a few tips on how to develop a decent forehand, the strange old woman says good-bye, twiddles with a small device attached to the cord of her dressing gown, and vanishes.

As a result of the conversation, you begin to take tennis lessons and, sure enough, you become a star. Your career is long and successful, including a victory at Wimbledon in 1999. When your playing days are over, you relax into a happy retirement.

At nine o'clock on a lazy evening in 2054, you are sitting by the fire and smoking a fresh cigar when you hear a knock at the door. You open it to find a nutty professor, who tells you that he has for years been trying to prove the possibility of time-travel by designing a time machine, traveling back in time, and murdering his grandfather. But now he has decided to move onto a more ambitious project, and is trying to raise money so that he can build a telescope that will allow him to see what is happening in other possible worlds. In a philanthropic mood, you give him a large amount of money and he gives you his old time machine in return.

What will you do with this device? There is only one thing that you would ever want to change about your life. You wish that you had not had such a miserable adolescence. So, you fasten the time machine to the cord of your dressing gown, play with the knobs a little, and all of a sudden you are in a black bedroom, standing before a girl you recognise as your teenage self. Never one to ask too many questions, you try to convince her that she has potential as a tennis player, hoping that the prospect of tennis stardom will cheer her up. After an hour of chatting, you are reminded of how unpleasant the

eighties were, so you say good-bye, twiddle the knobs on the time machine and find yourself back in your home, in front of the fire. The clock says that it is nine o'clock, but your wristwatch says that it is ten. The fire has not burned down any further while you were away, but the cigar that you took with you is almost finished. Never one to ask too many questions, you take a sip of port, have a faint memory of a strange old woman appearing in your bedroom when you were a teenager, and fall asleep.

5. The Four-Dimensionalist Interpretation

Here's an explanation of why our time-travel story is possible, told from a four-dimensionalist point of view. Four-dimensionalists believe that the universe is a four-dimensional space-time manifold, containing all events that happen at all times. One of those events is the sudden appearance in 1985 of an old woman, called Jennifer, in the bedroom of a teenage girl, also called Jennifer. The woman believes herself to have been transported from the future, and her memories and physical appearance are just like those of a woman who momentarily disappears on an evening in 2054. The girl and the old woman talk about tennis for an hour, then the old woman vanishes. As a result of the discussion, the girl begins to play tennis, and goes on to win Wimbledon in 1999. She retires, grows old, and on an evening in 2054 she answers the door to a nutty professor, plays with the knobs on a time machine, and disappears. Just a second after her disappearance, there appears in the same place a woman with all the same physical and mental properties, except that her wristwatch reads an hour later, her cigar is almost finished and she has memories of just spending an hour talking to her younger self.

Some questions – to do with personal identity and causation, for example – remain, and we will come to them in subsequent sections. But, leaving these questions to one side, Jennifer is a time traveler, or so it seems. Some will disagree; some will think that our time-travel story is impossible even on the four-dimensionalist view[8]. Such people, we suppose, will not think that it is possible on the presentist view either. We think that our time-travel story *is* compatible with four-dimensionalism, but we won't try too hard to change the minds of those who disagree. Our hope is to convince those who accept the four-dimensionalist story just given that the presentist can offer an equally coherent account. With this hope in mind, we shall next try to make good on our claim that sense can be made of our story from within a presentist framework.

6. The Presentist Interpretation

Presentists believe that the past and future do not exist, but most presentists will not go so far as to say that there are no past- or future-tensed truths. Past and future things do not exist, according to the presentist, but it is still true that John Denver broke down the barriers between country and pop and that the sun will rise tomorrow. And presentists agree that that some such truths are about presently existing entities. It is true that Shania Twain is breaking down the barriers between country and pop, it is true that Shania Twain was born in Canada, it is true – sadly – that she will die, and all of these truths are truths about the same Shania. Further, there are relations which hold between present and non-present things. Or at least, there are true sentences which appear to report relations which hold between present and non-present things. It is true that Shania Twain uses electric guitars more than John Denver did, even though there is no existing John Denver to make this true.

Presentists have used various strategies to explain how there can be past- and future-tensed truths, including truths that seem to report relations between present and non-present things. John Bigelow's explanation appeals to tensed properties of the present world, Mark Hinchliff's to non-existent entities, and Augustine's to present memories and predictions, perhaps in the mind of God[9]. We won't worry about exactly how the presentist should account for past- and future-tensed truths and cross-time relations, but it is clear that this has to be done somehow[10]. If the presentist cannot answer this challenge, then presentism is hopeless. We are assuming that presentism at least makes it to the starting line.

Imagine that it is 3pm on the 4th of June, 1999. Suppose that presentism is true; the only things that exist are the things that exist right now. Still, there are plenty of past- and future-tense truths. Here are some of them. There is a woman named 'Jennifer' who is preparing to compete at Wimbledon. Jennifer was a glum, unhappy fourteen year old. In 1985, an old woman named 'Jennifer' suddenly appeared in Jennifer's bedroom, staying for an hour before disappearing again. Jennifer will win Wimbledon, and eventually she will enter a happy retirement. After a visit from a nutty professor, she will disappear in 2054, and then she will reappear with memories of having just spent an hour in a

black bedroom talking to her teenage self. When she reappears, her watch will say that it is ten o'clock, even though the clock in the room will say that it is nine.

You get the idea. The point is that all the details that featured in the four-dimensionalist story can be included in the presentist story too, so long as they are expressed as tensed truths properly relativised to the present. Four-dimensional time-travel is possible because it is possible that there are the right sorts of patterns of events. There is four-dimensional time-travel if the appropriate sorts of events occur at the appropriate sorts of times; events like people hopping into time-machines and disappearing, people reappearing with the right sorts of memories, and so on. But the presentist can have just the same patterns of events happening at just the same times. Or at least, it can be the case on the presentist model that the right sorts of events will happen, or did happen, or are happening, at the rights sorts of times. If it suffices for four-dimensionalist time-travel that Jennifer disappears in 2054 and appears in 1985 with the right sorts of memories, then why shouldn't it suffice for presentist time-travel that Jennifer will disappear in 2054, and that she did appear in 1985 with the right sorts of memories?

7. Personal identity

If Jennifer is really a time traveler, then the three Jennifers in the story must all be the same person. The Jennifer who gets visited by the old woman, wins Wimbledon, grows old and disappears in 2054 must be the same person as the Jennifer who appears for an hour in 1985 and as the Jennifer who appears as an old woman in 2054 and falls asleep in front of the fire. An alternative interpretation would be to say that it is a story not of one time traveler, but of three strange lives. One of the lives ends in a sudden disappearance, one begins with a sudden appearance and ends with a sudden disappearance, and one begins with a sudden appearance and ends with a normal sort of death. Why not read the story this way?

The problem of providing a criterion of personal identity across time arises even for those of us who are not time travelers. The Shania Twain who is presently breaking down the barriers between country and pop is the same person as someone who was born in Canada, even though there are many differences between the baby and the country singer (the baby, for example, was called ‘Eileen’).

What allows us to say that they nevertheless share an identity? There are various views: perhaps the baby and the singer are the same person because they are parts of the same causal chain; perhaps it is because they share a soul; perhaps it is because they have the same brain; perhaps the same body; perhaps because they are psychologically continuous. Let's just say that there is some relation *R* that both suffices and is required for personal identity across time. Anything and everything that stands in the *R*-relation to Shania is the same person as Shania[11].

To show that the three Jennifers are the same person, tell the story such that the *R*-relation holds between them. If your favorite account of personal identity allows you to tell such a story, then you should agree that, on your version of the story, Jennifer is a time traveler. If not, then you will have a reason to deny the possibility of this sort of time travel; you will not think it possible that one person could disappear at one time and reappear at a time in the distant past or future. But if this is what you think, then you should think that this sort of time-travel is equally impossible on the presentist and four-dimensionalist models. If temporal continuity is to be part of the *R*-relation, then time travelers (of this sort) are to be had on neither model.

To show that a plausible view of personal identity will allow for the possibility of both presentist and four-dimensionalist time travel, consider the way in which Lewis deals with the problem[12]. Lewis ascribes to a causal-continuity account of personal identity. The present Shania is the same person as the Canadian baby because the right sorts of mental and physical causal chains connect the past baby and the present singer. Such relations, Lewis says, hold in just the same way between a time traveler's various disjointed parts. There is a causal chain that runs from the Jennifer who wins Wimbledon through the Jennifer who appears in the black bedroom to the Jennifer who falls asleep in front of the fire. When Jennifer appears in 1985, she has memories of winning Wimbledon, of buying the time machine and so on, and she is physically similar to the Jennifer who disappears in front of the fire. That seems to be enough to say that she is the same person.

Lewis's answer is equally available to the presentist. The presentist believes that Shania was born in Canada, and that the Shania who was born in Canada is identical to the existing singer. Why? Because there is the right sort of causal chain. Properties of the existing Shania depend causally upon the properties that were had by the baby. But the same is true of Jennifer. The mental and physical

features of the Jennifer who appeared in the black bedroom – her memories and her wrinkles – depend causally upon the features that will be had by the Jennifer who will disappear in 2054. We think that Lewis deals adequately with the question of the time-traveler's identity, and we think that his solution is equally available to the presentist. In any case, we cannot see how the issue of personal identity raises special problems for presentist time-travel. If the four-dimensionalist can get away with saying that the three Jennifers are all the same person, then the presentist can too.

The discussion of personal identity and time-travel allows us to construct a notion of the time-traveler's personal time[13]. Objective, or external, time runs unremarkably from moment to subsequent moment. In external time, Jennifer arrives in the black bedroom years before she leaves from her chair beside the fireplace. But in her personal time, in time as experienced by Jennifer, her arrival in the black bedroom comes just after her departure from the chair beside the fireplace. We said earlier that two of the possible events that underlie the possibility of time-travel are Jennifer's disappearance in 2054 and her reappearance in 1985. But of course, in external time, her reappearance comes before her disappearance. It's only in her personal time that the reappearance is a reappearance. But that's OK, and it doesn't lead to a paradox, so long as we are aware that we are considering two different but compatible temporal sequences, sequences in which the same events can be ordered in different ways.

8. Causation

Time-travel stories – or at least, the time-travel stories that we claim to be compatible with presentism – involve causation at a temporal distance. We have causation at a temporal distance when the occurrence of an event at one time causes the occurrence of an event at some distant time, and there is no chain of causal dependence that links the two events across time. If personal identity across time requires relations of causation, then our story obviously involves causation at a temporal distance. But even if some other account of personal identity is the right one, it seems clear that some sort of odd causation will have to be a part of a time-traveler's life. The time traveler's twiddling the knobs of the time machine is the cause of a temporally distant event: her arrival at a past or future time.

There are some arguments for the impossibility of time travel that have to do with the sorts of causation that time travel stories require. In particular, it has been argued that the backwards causation

that time travel (into the past) requires is impossible. Some claim that the concept of causation itself rules out any backwards causation; it is argued to be a conceptual truth that for an event *c* to be the cause of an event *e*, *e* must occur later than *c*[14]. Others worry about what is known as the grandfather paradox. Suppose that what happens now can cause things to happen in the past. Then what's to stop me from changing the past? Might I not be able to do something now (like jumping into a time machine with a loaded gun and murderous intent) that will cause my grandfather to die too soon for him to be father any children[15]? Each of these ways of arguing against the possibility of causation at a temporal distance, however, would show that our time-travel story is impossible simpliciter; not that it is merely incompatible with presentism. There is no peculiarly presentist premise involved in either argument, so no particular problem is raised for presentist time travel.

Is there an argument against the possibility of causation at a temporal distance which is particularly targeted at the presentist? Presentists believe that temporal becoming, or the flow of time, is an objective feature of the world. One might claim, then, that causation must keep pace with the moving now. Causation, it might be said, must take place within the presentist now, and so causal relations can only hold between events that follow one after the other.

Surely, on a presentist view, all events must take place within the moving now. But causation is not an event, it is a relation between events, and relations between events are not the sorts of things that happen at a time. There are all sorts of (what seem to be) relations that hold between events that do not follow one after the other. Of course, the presentist will have to explain how there can be such seeming relations; how can it be true that the Sydney Olympics are more expensive than were the Melbourne Olympics, when there are no existing Melbourne Olympics for the Sydney Olympics to be more expensive than? But if presentism can get to the starting line, then the presentist will have to be able to explain such relations in one way or another.

If causation can be a cross-time relation on the four-dimensionalist view, then it can be one on the presentist view too. If the four-dimensionalist can say that the occurrence of *c* in 2054 causes the occurrence of *e* in 1985, then the presentist can say that *c* will occur in 2054 and *e* did occur in 1985, and *e* was the effect of *c* and *c* will be the cause of *e*. The question of whether the strange causation involved in time-travel is really possible should not divide presentists from four-dimensionalists.

9. Endurance and perdurance

Some cases of time travel involve a person being in two places at the same time. In our story, Jennifer travels back to the 1980s to talk to her younger self. For an hour, Jennifer simultaneously occupies two spatial regions. How is such a thing possible? Call this the bilocation problem[16].

How you should respond to the bilocation problem depends upon your view about how objects persist through time. Some think that objects persist by perduring, others that they persist by enduring. An object *perdures* through some interval of time by having a different temporal part at every instant in that interval. An object *endures* through an interval of time by being wholly present at each moment in the interval.

The perdurance theorist, whether she is a four-dimensionalist or a presentist, has a ready solution to the bilocation problem. A person's temporal part at *t* can be defined as the mereological sum of all the parts of her that exist at *t*. For someone who isn't a time traveler, it's convenient to think of *t* as specifying a moment in external time – the temporal part of Shania that exists now is the mereological sum of all the (spatial) parts of her that exist now. If we were to think of Jennifer's parts in this way, however, then there would be a temporal part of her in 1985 that includes the old and the young Jennifer. Jennifer would have a temporal part that has four hands and two heads and has a conversation with itself. The trick with regard to the time traveler, then, is to think of *t* as specifying a moment in the time traveler's personal time. Jennifer persists from baby to teenager to tennis star to old woman because she has a different temporal part located at each point in the personal time that follows the *R*-relation through each of these stages [17].

Just as the I-5 can be in Portland and Los Angeles at the same time by having a part in Portland and a part in Los Angeles, and just as someone can occupy two places in this room by having a leg over here and an arm over there, a person who visits her child self can be in two places at the same time by having a younger temporal part and an older temporal part (where these are defined relative to her personal time) in different spatial locations at the same moment in external time. The perdurance theorist denies that the person herself, the persisting object, is completely located at any single region of space or moment in time. Only a part, at best a three-dimensional temporal part, of the person is completely located in any region of space at any single time. Once we embrace this picture of

persistence, we can quite comfortably think of a time traveler's older part paying a visit to her younger part.

Some think that perdurantism is incompatible with presentism[18]. The debate is complicated, and we won't discuss the question here[19]. Instead, we will try to show that, either way, presentism is compatible with time-travel; even the presentist endurantist should accept that time-travel is possible.

At first glance, it seems that the endurantist must rule out bilocation. How can a single object be *wholly present* in two different places at the same time? Whatever this mysterious phrase 'being wholly present' means, it seems that nothing can be wholly present twice over. If something is wholly present over here, then it ain't even partially, let alone wholly, present somewhere else as well! But appearances, we think, are deceptive.

The perdurance theorist claims that a persisting object is not wholly present at any single instant of its career. A persisting object exists at a time by having a temporal part that exists at that time. This is a sort of indirect existence. The endurance theorist denies this. We think that what it means to say that an object is wholly present at a time *t* is simply that it does not indirectly exist at *t*; it does not exist at *t* in virtue of having a part at *t*. This, plus the claim that there are persisting objects, is endurantism[20]. We think that nothing more should be added to the thesis of endurance itself, and that nothing more should be built into the claim that objects are wholly present at every instant of their careers. And if this is accepted, then nothing in the notion of being wholly present itself rules out bilocation.

Can an endurance theory say something more substantive about bilocation? An endurance theorist can usefully talk about temporal stages of a person's life without committing herself to the doctrine of temporal parts. She can usefully talk about someone's childhood, youth and old-age. And once she does this, she will be able to take over some parts of the perdurantist solution to the problem of bilocation. Ordinarily, a person's temporal stages can be individuated by reference to moments in external time. Someone's 20 year old temporal stage might correspond to the year 1992, his three year old temporal stage to the year 1975, and so on. Now, it is difficult to imagine two temporal stages of the one person which (completely) occupy a single place at a single time. And, ordinarily (i.e., for non-time travelers), at most one temporal stage of an individual is present at any given time, so, ordinarily, an agent doesn't have two temporal stages completely located at different places at the same time.

But why claim that it is *impossible* for an agent to have two temporal stages completely occupying different places at the same point in external time? That is tantamount to simply asserting that an agent cannot travel back in time and visit her younger self. And once we have seen the distinction between personal and external time, we can begin to make sense of an agent having two different temporal stages in different places, and thus, if the thesis of endurance is true, of being wholly present in two different places at the same time. If a time-traveler's personal time is out of line with external time in such a way that a later stage of the individual is located at the same external time as an earlier stage, then the agent will be in two places at once. This seems unusual, but not impossible.

Such a solution takes its cue from the perdurantist solution offered above. But can every endurantist accept such a suggestion? In investigating this question, we shall make a familiar distinction. Broadly, there are two sorts of endurance theorist. They are divided over their attitudes towards apparent intrinsic properties. (Some properties appear to be intrinsic properties. Shapes and sizes are good examples. Intuitively, whether or not something *a* is bent or red has nothing to do with anything other than *a*. We will be particularly interested in *temporary* apparent intrinsic properties— properties of which a thing can survive the gain and loss.) There are endurance theorists who maintain that there are genuine temporary intrinsics and individuals simply instantiate or have such properties, and there are those who maintain either that all apparent temporary intrinsics are really relations between individuals and times, or that the instantiation relation is relativised to a time. Let's call the first sort of endurantist the *non-relativiser*, and the second sort the *relativiser*[21].

This distinction within endurantism has its roots in the puzzle of change. Naively, the puzzle of change is this. Suppose that *a* changes; *a* goes from being an *F* to being a *non-F*. A thing changes just in case *it* has some given property and *it* has that property's contrary. (It would not be a change if *a* is sitting and some distinct object *b* is standing. It must be *a* that sits and *a* that stands.) But this entails that if *a* changes, then *a* has the property of *being an F* and has the property of *being an non-F*. But nothing has a property and its contrary. So change is impossible.

There must be something wrong with this argument, and it is quite clear where the error lies. In giving the argument, we dropped the temporal modification. We started by saying that *a goes from* being an F *to* being a non-F. But then we claimed that *a has* (without any temporal modification) both

F-ness and *not-F-ness*. And therein lies the error. The residual difficulty is to say exactly how this temporal modification makes a difference. What is the temporal modification modifying? According to the perdurantist, the temporal modification modifies the subject of the predication. *a* has distinct temporal parts at *t* and *t'*, respectively, and *a*-at-*t* is sitting and *a*-at-*t'* is standing. According to the endurantist relativiser, the temporal modifier modifies either the predicate, and thus the property itself, or the instantiation relation; the sentence '*a* is sitting at *t*' says either '*a* has the property *sitting at t*' or '*a* has at *t* the property *sitting*'. The endurantist non-relativiser maintains that the temporal modifier modifies the entire sentence.

Here's how this bears on the bilocation problem. Consider our story. Jennifer goes back in time and visits her younger self. At age 84 her hair is white; at age 14, let us say, it is jet black. Consider the time at which her older self is standing before her younger self. If Jennifer is an enduring object, then she is wholly present twice over in 1985. But worse, she is both white-haired and not white-haired. Contradiction.

If you are a relativiser, then you can choose either of two ways to solve this problem. Each solution requires another piece of relativising, but this is in the spirit of the view. First, you can trade on the distinction between personal and external time, and say that Jennifer has the properties *being white-haired at 1985 and age 84* and *being black-haired at 1985 and age 14* (or that Jennifer *has-in-1985-at-age-84* the property *being white-haired*, and *has-in-1985-at-age-14* the property *being black-haired*). These are not incompatible properties. Second, you can relativise to place, as well as time; Jennifer is white-haired in 1985 at one place, and black-haired in 1985 at another place (or, she *has-in-1985-at-one-place* the property of being black-haired, and *has-in-1985-at-another-place* the property of being white-haired). Again, these properties are compatible.

Neither of these strategies is available to the non-relativiser, and, as far as we can tell, this sort of endurantist cannot solve the problem of bilocation. If properties like hair color are really temporary *intrinsics*, then the endurantist cannot have a black-haired Jennifer and a white-haired Jennifer existing at the same time. So the non-relativiser cannot solve the bilocation problem. Does this mean that, for the presentist endurantist non-relativiser, time-travel is impossible? Well, no, because not all sorts of time-travel involve a time-traveler who travels back or forward to a time at which she already exists. If

we had had Jennifer travel back to ancient China, instead of to 1985, then she would never have been in two places at once, and the bilocation problem would not have arisen. So the non-relativiser can believe that time-travel is possible, so long as it is not the sort of time-travel that has distinct temporal stages of a time-traveler existing at the same time.

But this sounds arbitrary. If the non-relativiser has to believe that you can set a time-machine to take you back to a time shortly before your birth, but not shortly after, then maybe she's better off just saying that time-travel is not possible at all. Better to deny time-travel's possibility than to place an arbitrary ban on only one sort of time-travel.

We don't think, though, that the ban is quite so arbitrary. After all, if the non-relativiser's view is correct, then it is just plain impossible to have distinct temporal stages of a person existing at the same moment in external time. It shouldn't be surprising, then, that time-travel stories which involve this phenomenon are impossible – they're just as impossible as time-travel stories in which someone travels back and kills his pre-pubescent grandfather. One way or another, the time-traveler must fail to travel to times at which she already exists. If she sets the time machine for a time at which she already exists, then she will be distracted before she pushes the 'Start' button, or the machine will malfunction, or whatever.

Alternatively, the non-relativiser could say that there are no time-travel machines, but only time-travel-or-person-duplication machines. If the time-traveler sets the machine for a time at which she already exists, then she will not travel to that time. Instead, she will disappear and there will pop into existence at the target time a new person who is qualitatively similar but not identical to the would-be time-traveler. This new person will be able to talk to the would-be time-traveler's younger or older self, and will (unless she is herself a non-relativiser with her wits about her) believe herself to be identical to that younger or older self, but will in fact be someone else (not that she is likely to care). However the non-relativiser chooses to account for the impossibility of one sort of time-travel, she should happily accept the possibility of the other sorts of time-travel. It is not arbitrary to rule out only the impossible stories[22].

10. But is this really time-travel?

The presentist believes that there are past- and future-tensed truths, but does not believe that the past or future exist. Should we then say that the presentist does not really believe in the possibility of time-travel, but only in the possibility of odd arrangements of past- and future-tensed truths? Perhaps we should. Perhaps presentist time-travel is not real time-travel, but only something that parodies time-travel, in the same way that the presentist arrangement of past- and future-tensed truths is only a parody of the past and future. But when it comes to telling stories, even this conclusion, we think, is strong enough. The presentist is just as entitled to tell time-travel stories as to tell any stories about things that happened in the past or will happen in the future. Even if presentist time-travel is not real time-travel, the presentist can be just as committed to the statement 'There might be time travelers' as she is to the statement 'It might rain tomorrow'. If presentism can get to the starting-line, and if our time-travel story is compatible with four-dimensionalism, then presentists should believe in the possibility of time-travel[23].

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[1] We don't mean to suggest that presentism and four-dimensionalism are the only possible, nor the only defensible, views on this matter. For one alternative, see Michael Tooley, *Time, Tense and Causation* (Oxford: Clarendon Press, 1997). Also see Robert Merrihew Adams, 'Time and Thisness' in (eds.) Joseph Almog, John Perry and Howard Wettstein, *Themes from Kaplan* (Oxford: Oxford University Press, 1989), pp. 23-42.

[2] We often hear these views expressed in conversation, although as far as we know they have not been defended in print. Theodore Sider mentions and then rejects the claim that there is no substantial disagreement between presentists and four-dimensionalists. See Sider, 'Presentism and Ontological Commitment', *Journal of Philosophy* 96:7 (1999), pp. 326-327. Another diagnosis of the debate between four-dimensionalists and presentists says that the issue has been settled by contemporary physics; in particular, it is said, if the special theory of relativity is correct then presentism can survive only as the solipsistic claim that nothing exists but the here and now. We will not pursue this question here, but see Hilary Putnam, 'Time and Physical Geometry', *Journal of Philosophy* 64:8 (1967), pp. 240-247, and Lawrence Sklar, 'Time, Reality and Relativity', in his *Philosophy and Spacetime Physics* (Berkeley: University of California Press, 1981), pp. 289-304.

[3] William Godfrey-Smith, 'Travelling in Time', *Analysis* 40 (1980), pp. 72-73.

[4] John Bigelow, 'Presentism and Properties', in James E. Tomberlin (ed.) *Philosophical Perspectives* 10 (1996), pp. 35-36.

[5] We have in mind here those time-travel stories that make essential reference to closed loops, or worm-holes, in space-time. Nothing we say will suggest that *these* stories are compatible with presentism.

[6] A version of the Nowhere Argument is presented by Godfrey-Smith ('Travelling in Time', p. 72). We say that the problem is that the departing time traveler has nowhere to go, but note that there's an exactly analogous problem for the arriving time-traveler: she has nowhere to come from.

7 David Lewis, 'The Paradoxes of Time Travel' in Lewis, *Philosophical Papers Volume II* (Oxford: Oxford University Press, 1986), pp. 67-80.

[8] D. H. Mellor, for example. See D. H. Mellor, *The Facts of Causation* (London: Routledge Press, 1995), ch. 17, and D. H. Mellor, *Real Time* (Cambridge: Cambridge University Press, 1981), pp. 171-187.

[9] Bigelow 'Presentism and Properties', p. 38. Mark Hinchliff, *A Defense of Presentism* (Princeton University Dissertation, published by University Microfilms, 1988), p. 102. Augustine, *Confessions*, translated by Henry Chadwick (Oxford: Oxford University Press, 1991), Book XI, sections 22-24 (pp. 233-235). For more on the ways in which presentists have tried to find truthmakers for non-present-tensed facts, see Bigelow's bibliography.

[10] Note that some presentists – Bigelow is an example – will deny that there are cross-time relations. What seem to be cross-time relations, on this view, are really relations between present things.

[11] Our talk of the *R*-relation is not supposed to prejudice the debate between perdurantists and endurantists. If you are a perdurantist, then you can think of the *R*-relation as a relation between temporal parts. If you are an endurantist, then you can think of it as picking out the conditions that are necessary and sufficient for a person's being wholly present at two different times; that is, as answering questions like, 'What makes it the case that the baby who is wholly present in Canada at one time is identical to the singer who is wholly present in Nashville at a later time?'.

[12] Lewis, 'The Paradoxes of Time Travel', pp. 72-74.

[13] We are following Lewis again. See 'The Paradoxes of Time Travel', p. 69.

[14]See, for example, Mellor, *The Facts of Causation*, pp. 220-229.

[15] On the grandfather paradox, see Lewis, 'The Paradoxes of Time Travel', pp. 75-80. See also Paul Horwich, *Asymmetries in Time: Problems in the Philosophy of Science* (Cambridge, MA: MIT Press, 1987). Horwich argues that the grandfather paradox shows that time travel entails the presence of inexplicable coincidences. For a reply to Horwich, see Nicholas J.J. Smith, 'Bananas Enough for Time Travel?', *British Journal for the Philosophy of Science* 48 (1997), pp. 363-389.

[16] Thanks to David Lewis for suggesting this term.

[17] Thanks to Josh Parsons for helping us to clarify our thoughts on this issue.

[18] See, for example, the following three articles, all by Trenton Merricks. Merricks, 'Endurance and Indiscernibility' *The Journal of Philosophy* 91 (1994), pp. 165-184; Merricks, 'On the incompatibility of enduring and perduring entities' *Mind* 104 (1995), pp. 523-531; and Merricks 'Persistence, Parts, and Presentism' *Nous* 33 (1999), pp. 421-438. See also William Carter and Scott Hestevold, 'On passage and persistence', *American Philosophical Quarterly* 31 (1994), pp. 269-83 (especially pp. 274-75). Both Merricks and Carter and Hestevold argue that any tensed theory of time – not just presentism – is incompatible with perdurance.

[19] In addition to the papers noted above, see Ned Markosian, 'The 3D/4D Controversy and Non-present Objects', *Philosophical Papers* 23 (1994), pp. 243-249; Dean Zimmerman, 'Persistence and Presentism' *Philosophical Papers* 25 (1996), pp. 115-126, and Theodore Sider, 'Four-dimensionalism' *Philosophical Review* 91 (1997), pp. 165-184.

[20] Ned Markosian makes a similar suggestion in 'The 3D/4D Controversy'.

[21] For discussion of the different types of endurantism, see Zimmerman, 'Presentism and Persistence'. See also Mark Johnston, 'Is There a Problem About Persistence?', *Proceedings of the Aristotelian Society, Supp. Vol.* LXI (1987), pp. 107-135; and Sally Halsanger, 'Endurance and temporary intrinsics', *Analysis* 49 (1989), pp. 119-125.

[22] The comments of an anonymous AJP referee helped us to improve this section.

[23] For helpful comments, thanks to David Lewis, Bradley Monton, Josh Parsons, Nicholas Smith, an AJP referee and an AJP editor.