

Traveling in A- and B- Time*

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Some say that presentism precludes time travel into the past since it implies that the past does not exist, but this is a bad argument. Presentism says that only currently existing entities exist, and that the only properties and relations those entities instantiate are those that they currently instantiate. This does in a sense imply that the past does not exist. But if *that* precluded time travel into the past, it would also preclude the one-second-per-second “time travel” into the future that is ordinary persistence, for presentism accords the future the same ontological status as the past. Instead of quantifying over past and future objects and events, presentists speak a tensed language, regimented with primitive sentential tense operators. For a presentist, a persisting person is one who *did* exist, and who *will* exist. Regimented, these claims become: *it was the case that she exists*, and *it will be the case that she exists*. The presentist may then apply the same strategy to time travel proper. Suppose Katy travels back to the time of the dinosaurs. The presentist can say that *it was the case two hundred million years ago that Katy exists*. This claim, which consists of a present-tense statement “Katy exists” embedded within the past tense operator *it was the case two hundred million years ago that*, is exactly the sort of statement about time that a presentist is free to accept.

This has all been made clear by Simon Keller and Michael Nelson (2001). In addition to rebutting the bad argument against the consistency of presentism and time travel, Keller and Nelson argue positively in favor of consistency by showing how to translate David Lewis’s (1976) account of time travel into the presentist’s tensed language. The appearance of conflict between presentism and time travel, they argue, is due only to the fact that most defenders of time travel (for example Lewis) have tended to phrase their defenses in non-presentist terms. As much as I applaud their rebuttal of the bad argument, I wish to sound a note of caution. There is one — important! — bit of Lewis’s defense that may not survive translation into presentist terms. In fact, other “A-theories” of time, and even some “B-theories”, produce the conflict as well.

Let us set aside presentism for the moment, and examine Lewis’s non-presentist account of time travel. As Lewis says, time travel involves a “discrep-

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ancy between time and time” (1976, p. 67). Before entering my time machine, I may say: “in two minutes I will gaze upon a dinosaur”. This utterance appears paradoxical: how can the event of my gazing at the dinosaur be two minutes *after* my utterance (since, as I say, I “will” gaze at a dinosaur), and also two hundred million years *before* my utterance, back in the time of the dinosaurs?

That such utterances be correct in *some* sense is vital to the vindication of time travel, the sort of time travel in science fiction stories anyway. For suppose that my dinosaur viewing is in no sense located two minutes in my future. Then it seems wrong to say that I *travel* in time. What is true instead is that I once viewed a dinosaur, two hundred million years ago. I would be no time traveler, only a person with a temporally disconnected lifespan.

Lewis resolves this paradox by distinguishing “personal time” from “external time”. External time is time itself, global time, the time with respect to which I am traveling backwards into the past. Personal time is a measure of the changes undergone by a time traveler. My two-hundred million year journey back in external time counts as taking two minutes of my personal time if, during that journey, I have undergone two minutes’ worth of change — that is, undergone the sorts of changes that normally occur to a person during two minutes of external time. The direction of personal time is perhaps related to entropy: the future direction of personal time is the direction of increasing entropy within the time traveler. Causation, not unrelatedly, also plays a role: the later stages in one’s personal time are caused by the earlier stages. A world with time travel into the past will therefore include causation of (externally) earlier effects by (externally) later causes. Thus, what is distinctive about a time traveler is that the changes she undergoes are out of sync with the changes occurring in the rest of the world. The river of causation and change generally flows in a certain uniform direction and rate; time travelers are local currents in which this flow is altered or reversed.

Lewis says that personal time, thus understood, “isn’t really time, but it plays the role in [the life of a time traveler] that time plays in the life of a common person” (1976, p. 70). But is this right? Does personal time, as defined by Lewis, really play the role for time travelers that external time plays generally? The answer depends on the nature of external time, especially the distinction between past and future.

Suppose first that a maximally *spatializing* account of time is correct. This account has three components: *eternalism*, according to which events, times and objects from the past, present and future are equally real; *reductionism about*

tense, the view that tensed statements have tenseless truth conditions¹; and *reductionism about the direction of time*, perhaps to the direction of causation, or perhaps to some asymmetry in matters of particular fact such as entropy. (The conjunction of the first two components is often called the “B-theory” of time.) Given this spatializing account, personal time looks a lot like external time: talk of what will happen in a time-traveler’s personal future is very similar to talk of the external future of a normal person. In each case the talk concerns a sequence of genuinely existing person-stages (or events) ordered by causation or entropy. The time traveler’s sequence differs extrinsically from the normal person’s sequence: the causal and entropic order of the time-traveler’s sequence does not match that of most other sequences. But the intrinsic features that order personal time are the same causal relations or asymmetries that determine the global direction of external time.

On certain other views about the nature of external time, however, dissimilarities between external time and Lewisian personal time emerge. How striking they are depends on the extent of the departure from the spatializing picture. Consider, for instance, the combination of the first two components of the spatializing picture — the B-theory of time — with the claim that time has an intrinsic direction, which is irreducible to causation, entropy, or anything else.² Talk of the personal future and talk of the external future continue to concern sequences of genuinely existing stages, but what orders those sequences is very different. Talk of one’s external future concerns stages that are forward in the intrinsic ordering of time, whereas talk of a time traveler’s personal future concerns stages that are causally and entropically downstream from the current stage.

Or consider C. D. Broad’s (1923, chapter II) conception of time as a “growing block universe”. Broad rejects all three components of the spatializing picture. First, while past and present entities exist, future objects do not. Second, while (some) past-tensed statements may be given tenseless truth conditions, future-tensed statements cannot be. An utterance of “there once were dinosaurs” could be regarded as true iff there exist dinosaurs located before the utterance. But no true claim about the future could be reduced in this way if the future does not exist. If an utterance of “People will still live on Earth in two hundred years” is true iff there exist humans living on Earth that are located two hundred years after that utterance, then the utterance turns out false if

¹See my 2001, chapter 2, section 1.

²See, for instance, Maudlin (Forthcoming).

future objects do not exist.³ And even some past tensed utterances, namely, utterances about the growth of the block universe itself, cannot be given the usual tenseless truth conditions. The sentence:

The futuremost edge of reality — the “crest of the wave of being”
— was once located in 1900

is true, but the crest of the wave is (now) in 2004, not 1900. Third, the direction of time for Broad is not reducible to entropy or causation. Rather, the future end of the growing block universe is defined as the end onto which “new layers of being” are being added (however this addition is ultimately understood).

On Broad’s view, talk of the external future is extremely different from talk of the personal future. Talk of the external future is not talk of a sequence of genuinely existing stages, for future stages do not exist according to Broad; whereas talk of the personal future of someone who travels into the past *is* talk of a sequence of genuinely existing stages (since those stages are all located in the external past and hence exist). And the directionality of personal time reduces to causation or entropy, whereas this is not true for the direction of Broad’s external time.

And now let us finally return to presentism. Like Broad, the (typical) presentist rejects each component of the spatializing picture. First, neither past nor future objects exist. Second, tensed statements are irreducible (since there are no past or future objects to which they may be reduced). Third, the direction of time is not a matter of causation or entropy; it is a matter of the difference between the *sui generis* past-tense operators and the *sui generis* future-tense operators.

This third fact about presentism — presentism’s anti-reductionism about the direction of time — is what renders presentist external time dissimilar from presentist personal time. One’s presentist external future consists of facts expressible with future-tense operators such as *it will be the case that*. As for the personal future, as Keller and Nelson point out, a presentist can, with only a little difficulty, translate pretty much everything Lewis says about personal time into tensed terms. Instead of claiming that *there exists* a dinosaur-viewing by me, located two hundred million years before the present time, the presentist can

³Some followers of Broad say that such sentences are true when their truth is settled by the portion of the block that exists plus the laws of nature. Another option is to accept irreducibly tensed truths that are ungrounded. Either way, the truth condition does not involve quantification over an existent portion of the growing block universe.

say “it was the case two hundred million years ago that I am viewing a dinosaur”. Instead of ascribing a two-place causal relation to the events **my entry into the time machine** and **my viewing a dinosaur**, she can use a two-place tense operator “because ϕ , it was the case n units of time ago that ψ ” in the following tensed claim: “because I am entering a time machine, it was the case two hundred million years ago that I am viewing a dinosaur”.⁴ Instead of appealing to causal relations and qualitative differences between existent person-stages in the definition of personal time, the presentist can appeal instead to sequences of tensed statements describing causal and qualitative facts. Thus, my personal future concerns a network of past-tense causal statements about me. This is quite different from the nature of my external future, which does not concern causation at all, and which concerns *future-tensed* statements.

So according to presentism and certain other non-spatializing theories of time, personal time does *not* “play the role that time plays in the life of a common person”. This remark of Lewis’s is no throwaway; it is crucial to the status of Lewisian time travel as genuine *travel*. Recall my utterance just before entering the time machine: “In two minutes I will gaze upon a dinosaur”. Given the spatializing conception of time, this utterance is appropriate. My gazing at the dinosaur is in my personal future: it is causally downstream of my entry into the time machine, it occurs to an agent with appropriate psychological connections to me, and so on; and these connections are intrinsically similar to those that relate normal persons to their future experiences. A presentist cannot say the same. A presentist *can* use the words: “gazing at the dinosaur is in the future in my personal time”. But if personal time bears little similarity to external time then “personal time” is merely an invented quantity, and is misleadingly named at that. That I will view a dinosaur in my personal future amounts merely to the fact that I once viewed a dinosaur, and moreover that this is caused by my entry into a time machine. Since this fact bears little resemblance to the facts that constitute a normal person’s genuine future, I could not enter the time machine with anticipation and excitement at the thought of seeing a dinosaur, for it is not true that I am *about to* see a dinosaur, nor is the truth much *like* being about to see a dinosaur. If anything, I should feel fear at the thought of being annihilated by a device misleadingly called a “time machine”. The device causes it to be the case that I once viewed a dinosaur, but does not make it the case in any real sense that I *will* view dinosaurs.

The presentist I have described is anti-reductionist about the direction of

⁴See my 1999, p. 338.

time. She accepts distinct *sui generis* tense operators for past and future, for example: *it was the case that, it will be the case that, it was the case five minutes ago that, it will be the case five minutes from now that*, and so on. This view is universal among the presentists one reads, but it is not inevitable. A presentist could instead adopt primitive “undirected” binary tense operators. Here is one example:

it is the case five minutes “away from” now that ϕ and it is the case five more minutes away from now that ψ

This is not a conjunction; the whole statement is an irreducible whole. Though it is officially primitive, one can think of it as meaning:

Either [(it was the case five minutes ago that ϕ) and (it was the case ten minutes ago that ψ)], or [(it will be the case in five minutes that ϕ) and (it will be the case in ten minutes that ψ)]

The presentist could use this and related operators, rather than the directed tense operators, to state the fundamental facts, and then characterize a reduced notion of the direction of time in terms of these fundamental facts (perhaps by appealing to causation or entropy). This would draw personal time closer to external time, and make for a better vindication of time travel. The conflict between time travel and presentism thus does not issue directly from presentism itself, but rather from the usual presentist conception of the tense operators.

Alternatively, a presentist could retain the primitive difference between past and future tense operators, and instead distinguish two types of *sui generis* tense operators, one for external time, the other for personal time. But this would rule out *Lewis’s* defense of time travel, as it would constitute an invocation of “two-dimensional time”. Described from a spatializing point of view, the idea of two-dimensional time is that external time itself has two dimensions, and is therefore a plane rather than a line (let us set aside relativity). A non-time-traveler moves through the plane at a certain rate of time_1 per unit time_2 , whereas a time traveler proceeds at a different rate of time_1 per unit time_2 , and even a negative rate when traveling backwards. Time_2 is similar to *Lewis’s* personal time in that it is the “dimension of travel”: what we can anticipate as “about to happen to us” is what will happen in our future₂. But unlike *Lewis’s* personal time, time_2 is no second-class citizen: it is a fundamental part of spacetime structure.

Lewis objected that the two-dimensional picture does not allow time travel into one's own past. Since travel is always into the future₂, a traveler into the past₁ moves to a different point in the plane of time than her own past: the point of arrival and points in her past have different time₂ coordinates (1976, p. 68). In essence, the objection is this: if the arrival is in a fundamental sense after the departure — which it is if time₂ is a fundamental feature of time — then one has not *really* traveled into one's own past. The same complaint applies to the presentist analog of two-dimensional time. If there are two sets of equally fundamental tense operators, and one always travels in the future direction with respect to one of these sets, then no one really travels into her own past.

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According to Lewis, one *travels* into the past when the external past is in one's personal future. This is genuine travel only if personal time is similar to external time. And as we have seen, whether personal time is similar to external time depends on the nature of external time. This similarity is of course a matter of degree. Thus, our conclusion should be: concerning various possible scenarios, the label 'time travel' is clearly appropriate given a maximally spatializing conception of time, less appropriate given (certain versions of) presentism, and still less appropriate given other conceptions of time (for example that of the growing block universe).

And nothing here has challenged the consistency of presentism, or any other theory of time, with backwards causation.⁵ The question of this paper has not been *can we affect the past?*, but rather: *can we GO there?*

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⁵But note that it is possible to deny the possibility of backwards causation on the basis of i) an anti-reductionist theory of the direction of time, and ii) a reduction of causation to, among other things, the direction of time.

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