

Making sense of the growing block view

Natalja Deng

(*Philosophia*; final publication available at
<https://link.springer.com/article/10.1007/s11406-017-9832-1>)

Abstract: In this paper, I try to make sense of the growing block view using Kit Fine's three-fold classification of A-theoretic views of time.

I begin by motivating the endeavor of making sense of the growing block view by examining John Earman's project in 'Reassessing the prospects for a growing block model of the universe' (section 2). Next, I review Fine's reconstruction of McTaggart's argument and its accompanying three-fold classification of A-theoretic views (section 3). I then consider three interpretations of Earman's growing block model: the hybrid growing block (section 4), the purely tensed growing block (section 5), and Michael Tooley's growing block (section 6). I argue for three claims. First, Finean 'standard' versions of these views are less congenial to the growing blocker than 'non-standard' ones. Second, the hybrid view is problematic on either version. And third, 'non-standard' versions are not fully intelligible. I provide further support for the first and third of these claims and explain why I take them to support a minimal account of passage as succession, which undercuts some of the motivation for Earman's project (section 7). Lastly, I answer three objections (section 8).

1 Introduction

The growing block view is not only highly intuitively plausible, it's even gained a bit of support from cutting edge research in physics. In particular, some physicists working on the causal set theory approach to quantum gravity (Rideout and Sorkin 1999, Sorkin 2007) have described the dynamics of causal sets in terms that echo C. D. Broad's early pronouncements. C. D. Broad first set out the growing block view in *Scientific Thought*, as follows:

'[W]hen an event becomes, *it comes into existence*; and it was not anything at all until it had become ... The relation between existence and becoming is very intimate. Whatever is has become, and the sum total of the existent is continually augmented by becoming.' (Broad 1923, 68/9)

Roughly then, the view is that both past and present exist, but the future doesn't, and that time's passing consists in the coming into existence of new events. However, going beyond this rough description is surprisingly difficult. In fact, I'll suggest that there *is* no fully intelligible, more illuminating re-statement of the

position that still captures the intent behind the rough statement. That is, I'll argue that there are limits to the endeavor of making sense of the growing block view.

One might draw different conclusions from this. Traditionally, the kind of argument I'll make has been put forward in support of the claim that time doesn't pass. Another possible conclusion is that trying to make sense of the growing block model is misguided. Instead, I'll conclude that some of the motivation for finding room for the growing block view in modern physics is undercut.

The paper has seven parts. I begin by motivating the endeavor of making sense of the growing block view by examining John Earman's project in 'Reassessing the prospects for a growing block model of the universe' (Earman 2008) (section 2). Next, I review Kit Fine's reconstruction of McTaggart's argument and the accompanying three-fold classification of A-theoretic views of time (section 3). I then consider three interpretations of Earman's growing block model: the hybrid growing block (section 4), the purely tensed growing block (section 5), and Michael Tooley's growing block (section 6). I argue for three claims. First, Finean 'standard' versions of these views are less congenial to the growing blocker than 'non-standard' ones. Second, the hybrid view is problematic in either version. And third, non-standard versions are not fully intelligible. I then provide further support for the first and third of these claims and explain why I take them to support a minimal account of passage as succession, which undercuts some of the motivation for Earman's project (section 7). Lastly, I answer three objections (section 8).

2 Earman's growing block model

In 'Reassessing the prospects for a growing block model of the universe' (Earman 2008), John Earman does just that, both within Newtonian and relativistic settings, and finally in relation to causal set theory. What I want to comment on here is his view of the relation between various philosophy of time disputes about the growing block view and his own project.

Consider his discussion of the growing block view within the setting of Newtonian spacetime. He offers a growing block model of the universe. That model is made up of a set of spacetime models, and a relation on that set: $\langle \mathfrak{N}, \lesssim \rangle$. Each member of \mathfrak{N} is isomorphic to a future-truncated version ('chip') of a Newtonian block model, i.e. to a model that results from deleting from a Newtonian block model's manifold all points later some particular time (according to the distinguished global time function), and restricting the geometric and physical fields to the truncated manifold. The relation \lesssim holds between two of the spacetime models in \mathfrak{N} if and only if one can be isomorphically embedded as a submodel of the other. This is intended to correspond to the 'increase in existence' postulated by Broad.

Earman then discusses how to justify taking \lesssim to be anti-symmetric and connected, and how to ground the identity of entities modeled by different members of \mathfrak{N} . He also considers whether there is a sense in which a unique future-

inextendible Newtonian block model can be regarded as an ideal completion of the models in \mathfrak{N} .

Earman is motivated by the conviction that there is an important ontological difference between the growing block model and the block model. He takes this ontological difference to correspond to an asymmetry in how robust a variety of becoming these models (growing block, and block, respectively) contain. This conviction is an important driving force of central debates in the philosophy of time, shared by many. However, Earman seems to take such debates to be not only likely intractable, but also largely orthogonal to his concerns in this paper.

Of course, as Earman demonstrates, many interesting questions about the growing block view can be tackled independently of the more metaphysical debates in the philosophy of time. But the growing block model still needs interpreting, if we're to try to understand what it says about the nature of (space)time. Take, for example, Earman's claim that on the growing block model, it's true simpliciter that the future doesn't exist, because it's true in each of the spacetime models in \mathfrak{N} . Earman elaborates on this by saying that in order to talk of growth, proponents have to take such assertions to be merely perspectively true. That is, it's only from the perspective of each of the spacetime models that the (or its?) future isn't real. Otherwise, i.e. if each (or if one?) of these were absolutely true, there would be no growth.

But then further questions seem to arise at this point about how we should understand the perspectivity of these truths, and the ontological status of each spacetime model in \mathfrak{N} . As Earman stresses, perspectival truth is not to be understood as on the block model, signalling that relative to each time, later times don't yet exist. But how then? The sense of perspectivity in question is starting to look less familiar than it seemed at first sight. Moreover, it's clearly central to making sense of the view under discussion. When it comes to this task, Earman's formulation would appear to be of no more help than the more familiar 'sequence of inked columns of increasing height' (Earman 2008, 138).

To say this is not to contend that such issues are tractable. But it is to say that they are anything but orthogonal to Earman's concerns in this paper. Earman means to concede that his model doesn't deliver 'dynamism', and to leave to one side the question of whether that's a defect. But questions about 'dynamism' versus 'stasis' are intimately connected to the task of interpreting his model. If that model really is a model of a *growing* universe, then *prima facie*, it's dynamic. If it isn't, it doesn't serve Earman's purposes either.

3 Fine's three-fold classification

So how might we tackle this interpretive task? One tool we can use is Kit Fine's reconstruction of McTaggart's argument for the incoherence of the A-series (the series of events running from future to present to past).¹ As I see it, the value of that reconstruction is that it leads to an illuminating categorization of A-theoretic views.

¹ Some of what follows borrows from (Deng 2013). See (Deasy 2016) for a critique.

(I'll then apply that categorization to different versions of the growing block view.) I take A-theoretic views to be views that involve the rejection of one or more tenets of the block view (also known as the B-theory). These tenets are that at the fundamental level there are no tensed facts (this is anti-realism in the Finean terminology set out below), that all times and/or events exist (eternalism), and that there are no monadic, non-perspectival temporal properties like pastness or presentness or futurity.

As we'll see, Fine's reconstruction of McTaggart's argument relies on a concept of temporal reality, and of facts constituting or composing that reality. But we need not understand that concept in the particular way that Fine does, and some such concept seems to be presupposed by the opposition between the growing block view and block view as such. Most defenders of the block view nowadays hold that there are true tensed beliefs. For example, if I think the meeting will start in five minutes, this is a true future tensed belief if I have it at the right time, namely five minutes before the start of the meeting. So there is a very thin notion of a tensed fact that a defender of the block view can accommodate. But most metaphysicians would take it to be no part of the block view that there are tensed facts in temporal reality, understood in some metaphysically fundamental way. That is, a defender of the block view doesn't think that fundamentally, there are such facts as that the meeting will start in five minutes. Rather, he'd take there to be, fundamentally, only tenseless facts, such as the fact that the meeting's start occurs (tenselessly) at 12pm.

Fine offers two versions of his reconstruction of McTaggart's argument (Fine 2005, 2006). The first version assumes that there is a basic notion of constitution for temporal reality. It then distinguishes between the following four postulates, the first of which expresses the commitment to tensed facts the block view excludes:

Realism: Reality is constituted (at least, in part) by tensed facts.

Neutrality: No time is privileged, the tensed facts that constitute reality are not oriented towards one time as opposed to another.

Absolutism: The constitution of reality is an absolute matter, i.e. not relative to a time or other form of temporal standpoint.

Coherence: Reality is not contradictory, it is not constituted by facts with incompatible content.

Fine argues that these postulates aren't all compatible:

'It follows from Realism that reality is constituted by some tensed fact. There will therefore be some time t at which this fact obtains. Now Neutrality states that reality is not oriented towards one time as opposed to another. So reality will presumably be constituted by similar sorts of tensed facts that obtain at other times (given that there are other times!) . . . [A]ny reasonable view of how temporal reality might be constituted should allow for its being reasonably variegated over time; and presumably it will . . . then be constituted by incompatible facts, i.e. facts with incompatible contents. . . . By Absolutism reality is absolutely constituted by these facts; and this is then contrary to Coherence.' (Fine 2005, 272)

The second version of the reconstruction differs from the first in that it assumes merely that any notion of composition, whether basic or derived, must meet explanatory demands that mirror the above postulates.

Realism: Reality is composed of tensed facts.

Neutrality: No time is privileged, the facts that compose reality are not oriented towards one time as opposed to another.

Absolutism: The composition of reality is not irreducibly relative, i.e. its relative composition by the facts must be explained in terms of its absolute composition by the facts.

Coherence: Reality is not irreducibly incoherent, i.e. its composition by incompatible facts must be explained in terms of its composition by compatible facts.

The argument then proceeds along similar lines as before. A given notion of composition that conforms to Realism and Neutrality will be either relative or incoherent. That notion will then have to be explained in terms of a different, perhaps more basic, notion. If relative, it will have to be explained in terms of an absolute one, but that notion will then be incoherent. If incoherent, it will have to be explained in terms of a coherent one, but that notion will then be relative. In either case, there is an infinite explanatory regress.

As Fine himself argues, there are multiple ways out of this problem, even if one accepts Realism. The most straightforward is to reject Neutrality. The resulting standard realist view says that the fundamental tensed facts are indeed oriented towards one time in particular, namely the present. A certain privileged time is present, but other times were and will be present. Rejecting Absolutism instead is perhaps the next obvious move to make on behalf of Realism. On this view, which Fine calls external relativism, the fundamental tensed facts don't privilege a particular time. So it's a fact both that the meeting is starting and that the meeting will start in five minutes. But these facts compose reality relative to different times. On the last view Fine discusses, fragmentalism, Absolutism isn't given up, but Coherence is. The idea is that both these tensed facts compose reality absolutely, and there is no way to explain away the incoherence. Temporal reality is irreducibly incoherent. External relativism and fragmentalism are both versions of non-standard realism.

4 The hybrid growing block

With these positions in mind, let's now consider one of the most straightforward interpretations of Earman's growing block model. We can understand it as a hybrid view, combining what appears to be a B-theoretic block with A-theoretic times at which that block exists. There is an A-series of past, future, and present times, at each of which exists a different length truncated block universe.

Putting it this way already suggests a non-standard reading, on which the tensed facts are not oriented towards one time. On this version of the hybrid view,

all of the tensed facts, concerning all of the differently truncated blocks, equally compose reality. But these facts are either irreducibly incoherent, or they compose reality only relatively to those A-times. Let's focus on the latter non-standard view, namely external relativism. In a sense, all the A-times are on a par; but it's also the case that relative to each, reality is composed of tensed facts that say that one particular B-theoretic or quasi-B-theoretic 'time' is the 'latest'. I use the quotation marks, because it's not clear whether there really are *times* in each of the block universes. The real times are A-theoretic. There is time, and there is a quasi-temporal dimension that appears in each block. The quasi-times are (in the Newtonian case) to be thought of as the hypersurfaces of simultaneity associated with the distinguished global time function.

There is a standard realist version of the hybrid view, too. This view also posits an A-theoretically persisting B-theoretic block, but the tensed facts that compose temporal reality are oriented towards a particular time. Other, different length blocks, did and will exist, but only one particular length block now exists. And these tensed facts compose reality absolutely, not relative to times.

I take the non-standard version to be a more congenial interpretation of the hybrid view. The reason is not that somehow, the standard version implies that only one length block will ever or did ever exist; on the contrary, it says that other length blocks did and will exist. But the point of the standard version is that that it says this from the perspective of the one privileged, present A-time, because the composition of reality is absolute. While the hybrid view privileges the present in that it takes it to be the latest time of the block, its standard version privileges the present in a stronger sense. It takes it to determine which tensed facts compose reality. Earman's model of the growing universe doesn't, to my mind, license that kind of privilege. Complete parity between spacetime models seems part and parcel of the view he's discussing. And that parity doesn't seem to be as fully reflected in the standard picture of reality's composition as in the non-standard one.

There is a tension here, but it's a direct result of the way we tend to think of time's passing. Our intuitive picture of passage involves both the idea of metaphysical privilege, and the thought that that privilege is equally distributed across times. And while the first idea inclines us towards Realism, and Realism combines well with a rejection of Neutrality, the second thought inclines us towards Neutrality. Moreover, of the remaining two principles, Absolutism is decidedly less important than Coherence. In fact, Absolutism isn't congenial to the growing block view. If you think there's a continual increase in existence that constitutes time's passing, then the thought that the fundamental temporal facts compose reality only relative to times is a natural one. (I return to this point in section 7.)

Unfortunately, external relativism is hard to make sense of. Suppose t_1 is present, and suppose we wonder about the ontological status of tensed facts from other times. That is, suppose we wonder about the comparative ontological status of different spacetime models in \mathfrak{R} , one of which correctly describes spacetime as it is presently. For the relativist, it is a fact that t_2 is (objectively, non-perspectivally) present, but only relative to t_2 ; and it is a fact that t_0 is present, but only relative to t_0 . But what does that mean? These tensed facts from other times are not just the relativised tenseless facts that t_0 is present at t_0 and t_2 at t_2 , as a defender of the

block view would think. That's why there are different spacetime models involved at all. Nor are they the facts that earlier and later times will be present, as the standard realist version of the view would have it. Instead, they are '*alternative* realit[ies]' (Fine 2005, 279).

It is not appropriate, Fine says, to think of these alternative realities as perspectives on some more fundamental reality, nor to think of them as parts of a bigger reality, nor are they alternative possibilities for reality. Instead,

'... the differential manifestation of how things are is in itself integral to the very character of reality ... [R]eality as a whole "manifests" itself in these different ways, ... it becomes "alive" or "vivid" through certain realities holding rather than others.' (Fine 2006, 403)

It seems to me that these remarks do not succeed in giving any positive, literal content to the position in question. At best, they gesture in the direction of a view that can perhaps only be gestured at. They amount to a kind of prohibition to search for an understanding of temporal reality in the usual ways. What we are told is how not to think, rather than what to think, about time. (I return to the view in section 7.)

Recall that fragmentalism gives up Coherence rather than Absolutism. It thus also presents a way of respecting Neutrality, and of doing full justice to the intuitive picture of passage. Metaphysical privilege is somehow equally distributed across times, and yet the composition of reality is absolute. The resulting view is even harder to make sense of than external relativism. It's not clear how the view avoids outright contradictions (such as that two times are present, and that two spacetime models accurately describe the world presently). In fact, that contradiction seems part and parcel of fragmentalism, which after all is characterised by the thesis that reality is irreducibly contradictory.

A related question for fragmentalism is how exactly one should think of (A-)times. The question is what stops the fragments of reality, containing coherent tensed facts, from interacting. Fine speaks of the facts 'arranging' themselves into coherent fragments here, but why should they? And how do they, given that they all absolutely compose reality?²

Moreover, there's a deeper problem with the hybrid view that affects the non-standard and standard versions equally. This is that it's not clear how to understand the claim that the correlate of a spacetime model exists presently and persists, A-theoretically or otherwise. It's a strange claim. There is a latest 'time' in the model, but it's not a time, and so a fortiori it's not the present. But what is it? And how do the present and the latest 'time' relate? And to what extent does the hybrid view really align itself with modern physics, if it implies that 'spacetime' models don't model anything involving (space)time? (Though I won't argue for it here, I think this strange duplication of times also underlies the other objections that have been raised against the growing block view, namely the 'how do we know it's now now' objection raised in (Bourne 2002) and (Braddon-Mitchell 2004), as

² For defenses of fragmentalism, see (Lipman 2015, Lipman forthcoming).

well as the concern that ordinary tensed talk connects up only with A-times, not 'times' in the block (Pooley 2013, 11).)

5 The purely tensed growing block

The next interpretation that suggests itself is what Braddon-Mitchell has called the purely tensed growing block, PTGB (Braddon-Mitchell 2013, 357). I take this also to be the view defended by Tim Button (Button 2006, 2007). The main innovation here is that there are no quasi-times that stand in seemingly B-theoretic relations to one another. Before, there was a multiplicity of 'times' appearing in different length blocks. At a first pass, we can think of the new view as resulting from identifying these different 'times'. So what's left? Not a single block, with others being merely past or future blocks of different lengths; that was the standard realist version of the hybrid view.

I think the intended answer is that 'what's left?' is the wrong question to ask. It's of the essence of the view that what's real is relativized to times, and that not all times real-as-of one time are such that that time's real-as-of them. As of Monday, Sunday and Saturday are real; but as of Sunday, only Saturday and Friday (and all the previous times) are. The real-as-of relation is non-symmetric.

Prima facie, there are both standard and non-standard versions of this view too. Button's claim that different answers have to be given to the question 'what is real-as-of this time?' suggests a standard version. After all, standard realism says that the facts that compose reality are oriented towards one time. One time is present, though others were and will be. The PTGB equivalent of this is that one time is the latest time, though others were and will be. In particular, Friday is the latest time, but Thursday was. And this answer will have to be updated.

However, a standard reading of the view also involves the claim that the tensed facts that say this hold absolutely, not relative to times. This suggests that a non-standard reading does better justice to PTGB. It's not just that other times were and will be the latest ones. It's also that those earlier times that the tensed facts involve (e.g. Thursday) are such that the present doesn't exist relative to them. There is a hard to ignore echo of external relativism in this. What it is we posit at a given time is of a very peculiar sort. It's not a quasi-tenseless block that is itself present. Rather it's things like Thursday (given that today is Friday), where Thursday is such that Friday isn't real relative to it. That seems to call for more than the tensed fact that Friday wasn't present composing reality absolutely. It seems to call for that tensed fact composing reality relatively to Thursday. Times are purely tensed, and they are strongly on a par again.

Earman's model isn't as easily interpreted along the lines of PTGB as along the lines of the hybrid view. After all, he thinks of the different spacetime models as 'in every relevant sense different possible worlds', at least 'to the extent that the growing block model [...] is distinct from a block model with a shifting 'now'' (Earman 2008, 143) and not otherwise illicitly parasitic on a block model. But actually, PTGB doesn't resemble a moving spotlight view, nor does it seem to

increase the danger of parasitism on a block model. Perhaps the spacetime models can be taken to encode what is real-as-of their latest time.

If this suggestion seems strained, I think the reason is that it's hard to understand PTGB, and Earman's model seems intelligible. That is, what each spacetime model corresponds to on Earman's view seems like it should be something fairly straightforward. And perhaps even quasi-times are more straightforward than times that obey a non-symmetric existence relation. But this is no credit to quasi-times; rather, it's a sign of the strangeness of PTGB. As indicated above, I take that strangeness to be partly due to the strangeness of external relativism, which seems to be the best interpretation of PTGB.

Braddon-Mitchell also objects to PTGB on these grounds. Another worry he discusses is that PTGB invites the question how it differs from presentism. One reason you might think it doesn't (which I don't claim to be Braddon-Mitchell's) is that we arrived at PTGB by dropping the idea of seemingly B-theoretically related quasi-times. But then again, we also arrived at it by 'identifying' corresponding quasi-times of different length blocks. Given that that's so, is there any more reason to see PTGB as collapsing into presentism as there is to see it as collapsing into the block view? Pace Braddon-Mitchell, the triviality worry doesn't seem independent of the above problems with PTGB. At root, this objection too turns on the strangeness of the non-symmetric real-as-of relation. What distinguishes PTGB from presentism is that the tensed facts associated with a given time describe not just one existing, while others have and will, but one time being the latest time, while others were and will be. The problem is that it's not easy to make sense of facts that describe one time as being the latest time, without sliding back into a hybrid view. The PTGB's reply is presumably that the way to make sense of them is to take the real-as-of relation seriously.

6 Tooley's growing block

What about Michael Tooley's view (Tooley 1997)? Earman himself mentions it, and criticizes it chiefly on the grounds that it relies on untenable assumptions about relativistic physics. Those would of course be weighty grounds. But it's also worth considering the prior question to what extent Tooley's view is a successful attempt at making sense of the growing block model. (I'll be brief here, as these points have been made.)

The relevant elements of Tooley's view are as follows. There are two primitive notions of actuality, actuality simpliciter and actuality as of a time. Tenseless facts are basic, but the world is dynamic, because which tenseless facts are actual *as of now* changes as time passes. The past and the present are real but the future is not. Finally, any tenseless fact that is actual as of a time is thereby actual simpliciter; there is a mereological union of all facts that are actual as of some time or another.

Like Fine, Tooley is attempting to develop an alternative to traditional A- and B-theoretic views. But unlike for Fine, that alternative is intended not to be a form of (what Fine calls) realism – tenseless facts, not tensed facts are fundamental.

However, it's hard to see how this claim fits with the rest of Tooley's view. In order for his view to be dynamic, he wants to say that the totality of facts is different at different times. His way to make sense of this is reminiscent of external relativism: he holds that the facts are 'fundamentally, temporally relative' (Tooley 1997, 14), so that the basic notion of actuality is a temporally indexed one. Facts are, at the metaphysically most basic level, not actual simpliciter, but actual as of a time. The notion of actuality as of a time is reminiscent of the external relativist's notion of the temporally relative composition of reality. And yet, Tooley wants there not to be tensed facts, fundamentally. For example, what's actual as of now are exclusively tenseless facts, about things being thus-and-so at times earlier than or simultaneous with t_1 (the current time). But this is puzzling. What's actual as of now isn't merely those tenseless facts, but that those are *all* the tenseless facts. And that's a tensed fact.

If this objection is mis-construing actuality as of a time somehow, more needs to be said about how else we should construe it. Given the centrality of the notion, it's not enough to insist that it's neither being present or past, nor being simultaneous with or earlier than. As Quentin Smith notes (Smith 1999), taking the notion as primitive seems equivalent to making an unanalyzable claim that there is a middle ground between A- and B-theories here.

7 Whither the growing block?

Let's now take stock. I considered five interpretations of the growing block model: standard hybrid, non-standard hybrid, standard PTGB, and non-standard PTGB, and Tooley's growing block. I argued for three claims. First, standard interpretations aren't as congenial to the growing blocker as non-standard ones; second, the hybrid view's duplication of times is problematic; and third, non-standard views are rather hard to make sense of. In this section, I briefly re-visit the first and third of these claims and describe what I take to be the upshot for the growing block view.

Consider standard growing block views again. Diekemper holds that while the growing blocker has more interpretive work to do than can be done by answering Fine's challenge, he, like the presentist, must give up Neutrality (Diekemper 2014, 5). The reason, Diekemper says, is that the growing blocker, like the presentist, ontologically privileges some times over others. That is, the growing blocker ontologically privileges non-future times.

As mentioned, I recognize that there is a tension between Neutrality and any position that rejects eternalism. But I find it hard to ignore the sense that something has gone missing in this way out of Fine's dilemma. The reason inconsistency loomed with Neutrality was that all the tensed facts taken together seem incompatible. The standard realist avoids this problem. But that's because the standard realist posits only some of the tensed facts that naturally present themselves. Suppose it's Friday today. Then the tensed facts that Friday is the latest time, and that Thursday was, are compatible. But the tensed fact that Thursday is the latest time has to be left out. And that means one of the spacetime models in \mathfrak{R} has been privileged.

The standard realist might insist that at this meta-level, metaphysical privilege can stand unopposed. And so it can. My objection isn't that this view is static, i.e. that it fails to entail that time passes. It's that it doesn't do justice to our intuitive picture of passage, which requires privilege and parity between times in equal measure (including at the meta-level). If I'm right that the picture is characterized by this tension, then this itself suggests that not fully capturing it isn't a theoretical defect, in the sense that it involves mis-characterising one's subject matter. But it can still (and, I maintain, does), amount to settling for something less than the growing block model, with its opposition to the block model, led one to hope for. I could also say it amounts to settling for something *different*: it's a surprising finding if on all levels of metaphysical theorising, the best interpretation of \mathfrak{N} involves a lack of parity between its members.

Note that the claim is not that the growing block view as such is incoherent. Barring the problems with the hybrid view, we have found two standard readings of the growing block view that are coherent. It's that there is a good reason why Tooley made the claims he made, one that is intimately connected with what the growing block model promises. Consider his statement that 'one needs to be able to offer an account of the concept of a total, dynamic world, as contrasted with the history of a dynamic world up to some point in time.' (Tooley 1997, 40) As mentioned, the standard realist view is able to do that, from the perspective of the present time. But it's not hard to see why Tooley was looking for something else. He continues, ' X is an actual, temporal entity or state of affairs means the same as X is part of the mereological whole that is composed of every state of affairs that is actual as of some time t or other'. The sub specie aeternitatis point of view, characterized by Neutrality (and in particular, by non-Absolutism), goes very well with the growing block model.

So I think non-standard versions of the growing block view are more congenial. If so, and if the hybrid view is problematic in any version, then the best construal of the growing block model is non-standard PTGB. External relativist PTGB in particular is a real contender. That is, it's a real contender if one doesn't mind not making the kind of sense I've been trying to make. I've said that external relativism amounts to a kind of conceptual gesture. I think one stance that is open to a growing blocker is to hold that this is precisely the kind (and amount) of sense we should expect a truly dynamic theory of time to make. Perhaps that's the right stance. But the view in question is hard to understand: both the external relativistic 'differential manifestation of how things are', and PTGB's non-symmetric real-as-of relation (perhaps encoded by the different spacetime models in \mathfrak{N}) are difficult to grasp. Thinking about them ultimately requires something like giving up on trying to understand. So this stance still involves acknowledging that there are limits to the endeavor of making sense of the growing block view.

As mentioned at the outset, one might draw different conclusions from this. In particular, three possible conclusions present themselves.

First, this kind of argument has often been presented as supporting the claim that time doesn't pass. That way of looking at things takes this kind of argument to establish something truly astonishing. We would then have found out from the

armchair that the ‘growth’ of a causal set can’t really be a growth at all, but has to be, if anything, a static phenomenon.

The second reaction lies at the other end of the spectrum, in the sense that it takes the exercise (even if I’m right about all three claims) to show merely that wanting to interpret the growing block model at all was a mistake after all. We would then have found out from the armchair that there is nothing to be done from the armchair here.

I favour a third response, which lies somewhere in the middle. I maintain that even though in trying to interpret the growing block model, we’ve hit limits of metaphysical theorizing about passage, we’ve learnt something. What we learnt isn’t that time doesn’t pass. It’s that the intuitive picture of passage, the way we tend to think of time’s dynamicity, isn’t a very helpful guide. That’s a significant result, because the intuitive picture is also intuitive to philosophers of physics and physicists in search of models of becoming. If I haven’t overlooked the right interpretation of Earman’s model, and if my three claims stand, then some of the motivation for projects like Earman’s (in that paper) is undercut, just like it would be if we’d found out that time didn’t pass. I suggest that the moral of the story is that we should replace the intuitive picture of passage with the conviction that time passes even according to a block model that posits merely a succession of times.³ If no literal sense can be made when we try to do full justice to the intuitive picture, then we should consider thinking about time’s passing differently.

8 Objections and replies

In this section, I respond to three objections. The first of these is directed at Fine’s argument against standard realism, and so it’s also relevant to my claim that standard versions of the growing block view are less congenial than non-standard ones. The second and third objections are directed at my conclusion, and in particular at the very idea of locating passage in a block universe.

8.1 Objection 1

In his ‘Argument from Passage’, Fine argues that standard realism doesn’t capture time’s passing, and so is no more dynamic than anti-realism, i.e. the block view: ‘[A]ll that the realist need add to the anti-realist’s ‘static’ account of the universe is the fact that a given time is present. And how could this solitary ‘dynamic’ fact be sufficient to account for the passage of time? Indeed, the realist’s conception of time is compatible with a view in which reality is frozen on the present, at it were, with there being no genuine passage but merely different static relationships of things in the past and the future to things in the present. His conception of temporal reality,

³ Similar views have been defended in (Savitt 2002), (Dieks 2006), (Dorato 2006), (Oaklander 2012), (Leininger 2014), and (Mozersky 2015).

for all that he has said, may be as static or block-like as the antirealist's, the only difference lying in the fact that his block has a privileged 'center'.' (Fine 2006, 405)

One point that could be made against this argument is that the standard realist's view doesn't simply add to the antirealist's. After all, he takes reality to be composed of tensed, and not tenseless facts, at the fundamental level. A related objection is that Fine's worry is simply misplaced. It's not the case that the standard realist's view is static, since according to standard realism, certain times will be present, and certain other times were present. Hence there is a succession of presents.

Oliver Pooley develops the latter objection by comparing the standard realist's account of passage to his account of ordinary change. Suppose for example that I sat down three minutes ago. Using metric tense operators, the standard realist captures this change by taking there to be, among the tensed facts that compose reality, facts such as these: (I am sitting) & WAS_{4min} (¬(I am sitting)).

In a structurally analogous way, the standard realist captures the passage of time by taking there to be, among the tensed facts that compose reality, facts such as these: WAS_{3min} (I am sitting down) & WAS_{1min} (¬WAS_{3min} (I am sitting down)).

The point can also be put as follows. Compare the pairs of tensed facts (I am sitting) & WAS (¬(I am sitting)), and (t_1 is present) & WAS (¬(t_1 is present)). If the former captures ordinary change, why shouldn't the latter capture the sui generis change that is the passage of time?

As an argument against Fine's claim that standard realism is static, this is persuasive. Standard versions of the growing block view are dynamic. Prima facie, the same objection can be raised against my claim that standard views don't fully capture (what I call) our intuitive picture of passage. How could anything be left out, when the standard realist's account of change succeeds too?

In response, let me describe again what I think is at stake in the debate, i.e. what drives the search for more dynamic views than the block view. I maintain that it's an expectation of more than (or something different from what) the standard view, though dynamic, delivers. Consider again the sets of tensed facts that are left out, because they obtain at other times. They are not required to secure that time passes, because other times were and will be present. But they are just as relevant to that process as the tensed facts that obtain now. They are not superfluous. When we imagine time's passing and think about it in this intuitive, A-theoretic way, the tensed facts from more than one time enter into the imaginative episode, because as soon as time passes 'on', another set obtains. That's why I think there is still a restriction inherent in the standard realist view, even if it's not a restriction that prevents dynamicity. Even privilege at the meta-level (of the composition of reality) isn't congenial to what the growing block view promised.

8.2 Objection 2

I've suggested that time passes according to the block model. For example, we might simply identify the passing of time with the successive occurrence of events. It's been said that this is a 'thin and yawn-inducing' sense of passage (Earman 2008),

whose advocates ‘seem to be making heavy weather of facts that (almost) no one has ever denied’ (Pooley 2013, 5). I must admit that in the present context, I don’t feel the force of this point. The claim has been that it turns out that we were wrong to expect an exciting robust account of what time’s passing consists in. It’s true that there is no dispute about whether or not there is succession according to the block model. The question though, is what it takes for time to pass, according to any model. The question is whether the continued search for ‘truly dynamic’ views is well motivated. I’ve argued that it isn’t.

8.3 Objection 3

The third objection follows on from the second. The thought, as I understand it, is that it doesn’t make sense to claim that time passes according to the block model, because A-theoretical concepts are simply part of the definition of the technical term ‘passage’. At best, the claim amounts to the recommendation to re-appropriate the label ‘passage’ for B-theorists, a move that probably promises more confusion than anything else.⁴

This is an interesting objection, but one that I think is ultimately unpersuasive. I can think of two things the objector may have in mind. The first is that there is *no* pre-theoretic notion of passage or dynamicity that one brings to the debate, so that ‘passage’ just denotes whatever it is most of the theories standardly classed as A-theories have in common. But that would be puzzling. First, pointing out that the B-theory is a static theory of time would then be like saying that a particular theory of music isn’t a theory of sport (something that all theories of sport have in common by definition). It would be redundant and unilluminating. Second, such a definition, even if it were standardly given (which it isn’t), would be strange in itself. Why think that the diverse theories of time standardly called A-theories have *anything* in common? The standard answer to the question is that many of them seem well placed to account for time’s passing. But on the objector’s way of looking at the debate, that would be true by definition, so the grouping would be brute and unmotivated.

The second thing the objector may have in mind is that we do have a pre-theoretic grasp of what time’s passing is because we experience it; but we can tell by inspection that only A-theories can take that experience to be veridical. That is, we can tell by inspection that we have an experience as of something A-theoretic, and so we can define the B-theory as a theory that doesn’t take that aspect of temporal experience to be veridical (though it may still be able to explain it away). This suggestion accommodates the intent behind portrayals of the B-theory as static. However, it depends on substantial judgements about temporal experience that are up for debate. Contra the objector, whether we have experiences as of something A-theoretic doesn’t seem adjudicable by simple introspection.

⁴ I think David Braddon-Mitchell may have raised this objection in discussion, but I don’t claim that this section accurately represents his views.

9 Conclusion

I've applied the Finean classification of A-theoretic views to candidate interpretations of the growing block model. I considered hybrid, purely tensed, and Toolean growing block views, and argued that of these, the purely tensed one is the only real contender. I suggested that a non-standard, and more specifically, an external relativist reading of the purely tensed growing block view is the most natural. However, I also argued that external relativism amounts to no more than a conceptual gesture, and so is not fully intelligible. In my view the culprit is an A-theoretic way of thinking of time's passing, which should be replaced by thinking of it as succession. On that view, some of the motivation for assessing the prospects of the growing block view in the light of modern physics would be undercut.⁵

References

- Bourne, C. (2002). When am I? A tense time for some tense theorists?, *Australasian Journal of Philosophy* 80 (3): 359 – 371.
- Braddon-Mitchell, D. (2004). How do we know it is now now?, *Analysis* 64 (3): 199–203.
- Braddon-Mitchell, D. (2013). Fighting the zombie of the growing salami, in K. Bennett and D. Zimmerman (eds.), *Oxford Studies in Metaphysics 8*, Oxford: Oxford University Press, 351.
- Broad, C. D. (1923). *Scientific thought*. New York: Harcourt, Brace & Co.
- Button, T. (2006). There's no time like the present, *Analysis* 66 (290): 130–135.
- Button, T. (2007). Every now and then, No-futurism faces no sceptical problems, *Analysis* 67 (296): 325–332.
- Deasy, D. (2016). Philosophical arguments against the A-theory, *Pacific Philosophical Quarterly* 97 (2).
- Deng, N. (2013). Fine's McTaggart, temporal passage, and the A versus B debate, *Ratio* 26 (1): 19-34.
- Diekemper, J. (2014). The existence of the past, *Synthese* 191 (6): 1085-1104.
- Dieks, D. (2006). Becoming, Relativity and Locality, in D. Dieks (ed.) *The Ontology of Spacetime, Volume 1*, Amsterdam: Elsevier Science, 157–77.
- Dorato, M. (2006). Absolute Becoming, Relational Becoming and the Arrow of Time: Some Non-conventional Remarks on the Relationship Between Physics and Metaphysics. *Studies in History and Philosophy of Modern Physics* 37: 559–76.
- Earman, J. (2008). Reassessing the prospects for a growing block model of the universe, *International Studies in the Philosophy of Science* 22 (2): 135 – 164.

⁵ Thanks to Graeme Forbes for prompting me to write this paper, and to him, Steve Savitt, and Emily Thomas for helpful comments on an earlier draft. The paper was partly written while I was a member of the TWCF project 'Theology, philosophy of religion, and the sciences' and partly while I was supported by the Yonsei University Future-Leading Research Initiative of 2018 (2018-22-0100).

- Fine, K. (2005). Tense and reality, in K. Fine (ed.) *Modality and Tense: Philosophical Papers*, Oxford: Oxford University Press, 261–320.
- Fine, K. (2006). The reality of tense, *Synthese* 150 (3): 399–414.
- Leininger, L. (2014). On Mellor and the future direction of time, *Analysis* 74 (1): 148-157.
- Lipman, M. (2015). On Fine’s fragmentalism, *Philosophical Studies* 172 (12): 3119-3133.
- Lipman, M. (forthcoming). A passage theory of time, in K. Bennett & Dean Zimmerman (eds.), *Oxford Studies in Metaphysics* 10, Oxford: Oxford University Press.
- Mozersky, J. (2015). *Time, language, and ontology: the world from the B-theoretic perspective*. Oxford: Oxford University Press.
- Oaklander, L. N. (2012). A-, B-, and R-theories of time: A debate, in A. Bardon (ed.) *The Future of the Philosophy of Time*, New York/London: Routledge, 1–24.
- Pooley, Oliver (2013). Relativity, the open future, and the passage of time, *Proceedings of the Aristotelian Society* 113: 321-363.
- Rideout, D., and Sorkin, R. D. (1999). Classical sequential growth dynamics for causal sets. *Physical Review D* 61: 024002-1-16.
- Savitt, S. (2002). On absolute becoming and the myth of passage, in C. Callender (ed.) *Time, Reality and Experience*, Cambridge: Cambridge University Press, 153–168.
- Smith, Q. (1999). Time, Tense and Causation. *Philosophical Review* 108 (1): 123-127.
- Sorkin, R. (2007). Relativity theory does not imply that the future already exists: a counterexample, in V. Petkov (editor), *Relativity and the Dimensionality of the World*. Springer.
- Tooley, M. (1997). *Time, Tense, and Causation*. Oxford: Oxford University Press.