**The Moving Open Future, Temporal Phenomenology, and Temporal Passage**

**Abstract**

Empirical evidence suggests that people naïvely represent time as dynamical (i.e. as containing robust temporal passage). Yet many contemporary B-theorists deny that it seems to us, in perceptual experience, as though time robustly passes. The question then arises as to why we represent time as dynamical if we do not have perceptual experiences which represent time as dynamical. We consider two hypotheses about why this might be: the temporally asperspectival replacement hypothesis and the moving open future hypothesis. We then empirically test the moving open future hypothesis. According to that hypothesis we represent the past as objectively fixed and the future open. And we represent that this objective openness moves as events that were open, become fixed such that in doing so we represent a privileged moving present. We found no evidence for the moving open future hypothesis, which suggests that further investigation of the temporally asperspectival replacement hypothesis is called for. Our results also shed further light on our understanding of the respects in which we represent the future to be open, which, in turn, has implications for our theorising about the open future.

**1. Introduction**

Dynamical theories of time are those on which time passes in the manner posited by A-theorists,[[1]](#footnote-1) such that there is some objective fact of the matter as to which events are present, and which events those are, changes as time passes. Call this *robust* passage.[[2]](#footnote-2) *Non-dynamists* deny that there is robust passage.[[3]](#footnote-3) They hold that there exist static relations of earlier-than, later-than and simultaneous-with, and that past, present, and future have no special metaphysical status but are merely relative: what is past relative to one event is future relative to another.

Some non-dynamists think that it seems to us, in perceptual experience, as though time robustly passes*.[[4]](#footnote-4)* These *passage illusionists* suppose that we are subject to a pervasive perceptual illusion, since time does not robustly pass. There are, however, obvious worries about such a view. How would we know what it is like to experience robust passage, given that there is none (Hoerl 2014) and so how could we be confident that this is the content of our experiences? Moreover, how could we come to have perceptual experiences with content as of robust passage, if, as naturalistic theories of perceptual content hold, said content is (at least in part) a function of mental states co-varying with the thing they represent (Prosser 2016).[[5]](#footnote-5) This had led some recent non-dynamists to reject the idea that it seems to us, in perceptual experience, as though time robustly passes. Such views are often known as deflationist.[[6]](#footnote-6) Many deflationists, however, concede that we believe (perhaps tacitly) that time robustly passes[[7]](#footnote-7) and, indeed recent empirical evidence has tended to confirm that this is so.[[8]](#footnote-8)

This raises a puzzle for deflationists: why do we represent that time robustly passes if it is both the case that (a) time does not robustly pass and (b) it does not seem to us, in perceptual experience, as though time robustly passes?

Some clarifications are in order here. When we say that people *represent* time as robustly passing, we mean that the content of their representation of time (which might be indeterminate in certain ways) is closer to a representation of time as robust rather than static. We assume that this is so if, when presented with descriptions of a world, people judge that a dynamical world is more like our world than is a static world. Notably then, people’s representations of time may be tacit. They may be unable to describe how they take time to be, and they may never have consciously tokened any thoughts about how they take time to be. Nevertheless, they are able to use their representations to make judgements about which world, dynamical or static, is most like they take our world to be. Moreover, we take it that even if this representation is tacit, it guides some of people’s behaviours.

With this in mind, previous empirical work suggests that ~70% of people (at least, of those US residents who were sampled) represent time as robustly passing (Latham, Miller and Norton 2021a, 2021b, 2020a). Assuming this empirical work is right, and most people[[9]](#footnote-9) do represent time as dynamical, deflationists owe some account of why people represent time this way if it does not even seem to them, in perceptual experience, as though time robustly passes.

In what follows in section 2 we outline two hypotheses:[[10]](#footnote-10) *the moving openness hypothesis* and the *temporally aperspectival hypothesis*. We then empirically test the moving openness hypothesis. In Section 3 we outline our methodology and results. In Section 4 we take up the implications of these results.

**2. Why do we represent time as dynamical: competing hypotheses**

We can discern two broad hypotheses regarding why people represent time as dynamical despite, if the deflationist is correct, not having perceptual experiences as of time robustly passing.[[11]](#footnote-11)

We call the first of these the *temporally aperspectival replacement hypothesis.* This view builds on Hoerl’s (2018) and Sattig’s (2019a 2019b) views. Starting with Hoerl. Hoerl (2018) argues that things presented to us in perceptual experience are not presented to us *as* present. What he means by this is that our perceptual experience has no temporal viewpoint.[[12]](#footnote-12) Our perceptual experiences have a spatial viewpoint—they represent not only the spatial relations between the things that we are seeing, but also represent that we are seeing them from a particular location in space. But the same is not true when it comes to a temporal viewpoint. While we can imagine perceiving the same things with the same spatial relations but from a different spatial viewpoint, we cannot imagine doing so from a different temporal viewpoint. Temporal viewpoint simply does not find its way into our experiences at all. As Hoerl puts it, it is not the case that “perceptual experience is best described as presenting us with events *as being present.* On the contrary it is in fact an important feature of the phenomenology of perceptual experience that nothing equivalent to tense features in it” (2018: 145).

One way to put this is that our temporal viewpoint seems to us to be *aperspectival,* while our spatial viewpoint does not.

With this is mind, we can notice that the contents of our perceptual states vary across time. Sattig (2019a; 2019b) suggests, for instance, that rather than having perceptual states that represent robust passage, instead they represent the *replacement* of our perceptual experiences. The idea, very roughly, is that our perceptual experiences as of qualitative change are accompanied by a sense of replacement, and that this sense of replacement is grounded in the representation of replacement in the content of those experiences. That is, our experiences represent not just that things are thus and so, but also represent the ‘replacement’ of experiences with new experiences.[[13]](#footnote-13)

Combining Hoerl’s (2018) and Sattig’s (2019) views, we can hypothesise that we have perceptual experiences that are temporally aperspectival, such that we experience not only a sequence of such

aperspectival perceptions, but in addition, we experience that these perceptions are replaced. Importantly, having such experiences does not amount to having an illusory experience as of robust passage. For it is not part of the content of these experiences that there is some objectively privileged present, and that which events are privileged in this manner, changes.

Nevertheless, it is not difficult to see how if we have temporally asperspectival perceptions which we represent as being replaced by new such perceptions, we might come to represent that the things represented are *genuinely aperspectivally*, (i.e. objectively) *present*. The idea is that because we don’t represent any temporal perspective in these perceptual experiences, we come to represent time itself as having no perspective to represent, because there is a fact of the matter as to which perceptions *really are* present. Moreover, we represent that which events these are, changes, because we represent that our temporally aperspectival perceptions are replaced, and hence change. So, the thought goes, although our perceptual experiences do not have content as of robust passage, having perceptions like this lends itself to our coming to represent time as dynamical.

This probably cannot be the full story. It seems very plausible that the sorts of perceptual mechanisms that ground our having such perceptions (if we do) are low level and shared (i.e. near universal amongst humans). We know, however, that ~30% of people report representing time as being static rather than dynamic. Moreover, since Latham, Miller and Norton (2021) found that levels of education and familiarity with science play no role in whether people represent time as static or dynamic, it is unlikely that the reason ~30% of people represent time as static is because they have learned to do so.

Our suggestion is that having temporally aperspectival perceptions that are replaced might be part, but not all, of the explanatory story: there is some other factor, or factors, that vary in the population, so that the presence of these factors in conjunction with these perceptions, explains why some, but not all, people represent time as dynamical. One possibility as to what that extra factor might be comes from Miller, Holcombe and Latham (2020), who suggest that people come to believe that they have perceptual experiences as of robust passage (even though they do not) because they use passage-friendly language; language that employs both moving time and moving ego expressions. Moving ego expressions are a suite of expressions which suggest that the ego moves through time. These expressions employ motion verbs such as ‘he is *nearing* his birthday’. Moving time expressions are a suite of expressions which suggest that time itself moves. These expressions employ motion verbs such as ‘his birthday is *approaching*’.

Miller et all argue that people are inclined to misdescribe the contents of their own perceptual states and thus to develop false beliefs about that content (i.e. to come to believe that it seems to them as though time robustly passes). Our thought, here, is that if people have temporally aperspectival perceptions that they represent as being replaced, then the difference in people’s reporting that time is dynamical (versus static) might be explained by people differentially employing passage-friendly expressions (be they moving time or moving ego). According to this view, people who employ more of these expressions are more likely to infer, based on their perceptions, that time is dynamical, than are those who use fewer such expressions.

So, one explanation that the deflationist might offer, is that in having temporally aperspectival perceptions that are represented as being replaced, we have perceptions that *can* be misdescribed as being perceptions as of robust passage. Further, people are more likely to misdescribe them in this manner when they employ passage-friendly language than when they do not. Thus, people who frequently employ passage-friendly language tend to come to represent time as dynamical, explaining why ~60-70% of people do so, while those who use less frequently employ passage-friendly language tend not to represent time as dynamical, explaining why ~30-40% of people represent time as static.

Of course, the broad explanatory story might be correct, here, but some factor *other* than passage-friendly language might be the relevant one, which modulates the extent to which people are inclined to describe, or understand, or otherwise conceptualize, the replacement of their temporally aperspectival perceptions as being experiences as of robust passage. We will call any hypothesis of this sort *a temporally aperspectival replacement hypothesis.*

A second broad hypothesis that the deflationist might appeal to, points to the connection between our representations of time, and our representations of the open future and fixed past.

The idea that there is some connection between our representing the future to be open and the past fixed, and our representing that time robustly passes, is not new. It has been argued that the growing block theory of time better accords with our belief that the future is open and past fixed than do other models of time, most notably eternalist ones.[[14]](#footnote-14) Since the growing block theory is a theory on which time robustly passes, if this is true then it might be part of the explanation of why many people believe that time robustly passes.

Indeed, some support for this idea is provided by Latham, Miller and Norton’s 2021 studies. As noted, they found that ~70% of participants judged time to be dynamical (that is, chose a dynamical model as being closest to the way they think our world is). Further, the most popular dynamical view (the one that most people thought was most like our world) was the growing block view. On this basis, Latham and Miller (2023) hypothesised that (some) people represent time as robustly passing because they are drawn to a growing block view of time in virtue of representing the future to be open, and the past fixed. They empirically investigated a particular version of this idea: namely that people take the future to be *deliberatively open*, and the past to be *deliberatively closed*, where the future is deliberatively open if what happens in the future is influenced by people’s current deliberations and choices, such that what they do in the future is, often, the product of what they intended to do, and is closed otherwise.

Latham and Miller wondered if people would tend to assume that if the future is deliberatively open, then future events do not exist. Since future events obviously *come* to exist at some point (when they are present) if people do make this assumption, then they will tend to represent our world as a growing block and hence as dynamical.

Interestingly, their empirical work did not provide support for this idea. They found no association between whether people represent our world to be more like a growing block than an eternalist world, and whether they represent our world to be deliberatively open or closed. Further, they found no evidence that people endorse the idea that if the future is deliberatively open, then this is reason to think future events do not exist.

This leaves open, however, that some other hypothesis that connects beliefs about the open future/fixed past to beliefs about temporal dynamism might be vindicated.

Prosser (2016) suggests that the reason we represent time as dynamical (even though it does not seem this way to us in experience) may be (partially) explained by our representing the past to be *objectively* *fixed*, and the future *objectively open.* He thinks we represent that there is an objective matter of fact as to which events *really are* fixed, and which *really are* open. We can contrast this with a view on which we represent it to be a merely subjective or relative matter which events are fixed and which open. On this latter view fixity and openness are largely epistemic notions, and a single event can be fixed relative to one subject or time, and open relative to another subject or time. We will call the former notion of fixity and openness *objective* openness and fixity, and the latter *subjective* openness and fixity.

The idea is that because people believe that there is objective openness and fixity, they then come to believe that time robustly passes. Here is how that explanation goes. People obviously believe that *which* events are open, and *which* fixed, changes. Indeed, they believe that events go from being open, to being fixed. Hence, if people believe that it is an objective matter regarding which events are open, and which are fixed, then they believe that there is objective change in which events are open, and which are fixed. But representing that there is a change in which events are objectively open, and which are fixed, requires representing that there is a privileged moment that stands ‘between’ the objectively fixed past events and the objectively open future ones, and that which moment that is, changes, as events that were open, become fixed. Representing that things are like this, however, is tantamount to representing that there is robust passage. For it amounts to representing that there is a privileged set of events—those between the fixed past and open future—and that which events these are, objectively changes as future events move from being open, to being fixed. This involves representing robust passage. We call this hypothesis *the moving open future hypothesis.*

In this paper we empirically test the moving open future hypothesis.

Importantly, some work in this area has already been undertaken. Hodroj, Latham and Miller (forthcoming), for instance, recently explored the connection between representing the future to be *nomically* open and representing it to be dynamical by being a growing block. They failed to find any association between representing the future to be nomicallyopen and representing it to be a growing block. Their study alone, however, does not tell us that the moving open future hypothesis is false. First, their study did not specify that the laws of nature in question are indeterministic towards the future, but not the past. Instead, in their study the world they describe as nomically open is one in which it is nomically possible that the future goes various ways, but in which it is left open that it is also nomically possible that the past could go various ways. If participants interpreted the nomically open world as one in which both past and future are nomically open, though, there is no reason to suspect that they would come to represent that in that world there is a privileged set of events that stands between the future and the past, such that which events those are, changes. That is to say, participants might not have interpreted the vignettes used in that study in such a way that they in the open future vignette they take there to be an *objectively moving* openness.

Moreover, even if we grant that participants did interpret the nomically open world as having a nomically open future and nomically closed past, and then did represent there to be a *change* in which events are nomically open and which nomically closed, it might still be that representing this change does not constitute representing objectively moving openness of the sort that explains why people come to believe that time robustly passes. After all, the laws of nature can be such that the future is nomically open, and the past nomically closed, and yet both past and future events exist. Yet it is not clear that *merely* representing there to be a change in which events are nomically open and which are nomically closed, conditional on all events, past, present, and future, existing, would be likely to generate a belief that time robustly passes. For instance, imagine a block world in which all that changes is which events are nomically open, and which closed. This change might not be sufficient for people to come to believe that time robustly passes in that world. Moreover, the idea that people do *not* tend to believe there to be a connection between temporal ontology and the truth of indeterminism/determinism is supported by the fact that Latham and Miller found no association between people taking our world to be a growing block world and taking the future to be nomically open.[[15]](#footnote-15)

Thus, although Latham and Miller’s study goes some way to ruling out *one way* of spelling out the moving open future hypothesis, it leaves open that there may be other ways in which people represent moving objective openness, which do explain their beliefs about time.

Another study in this regard is also instructive. Hodroj, Latham, Lee-Tory and Miller (2023) recently investigated the connection between representing the future to be *alethically* open and representing it to be dynamical by being a growing block world. They too failed to find any association between representing the future to be alethically open and representing it to be dynamical by being a growing block world. This, in conjunction with the findings of Latham and Miller (2023), might be seen to give us some reason to think that the moving open future hypothesis is false. However, the study by Hodroj et al focussed only on alethic openness: that is, it focussed on whether people believe that there are contingent future tensed truths that are neither true nor false, and, if they do, whether this is associated with representing time as dynamical. They found that it did not. It might be, however, that when people represent objective openness they represent something more than just alethic openness. Indeed, it might be that what is most salient to people, as regards the objective open future, is not that it is alethically open, but that it is open in some other way. And it might be that because people represent the future as objectively open in this thicker sense, they tend to represent time as dynamical. None of the studies conducted so far speak to this.

In the current study we aim to be much broader and looser in spelling out the general idea and flavour of objective openness, so that we can determine whether there is any association at all between people having *some sort* of representation of objective openness, and them believing that time robustly passes.

To do this, in our vignettes we use a range of different locutions to try to pick out the idea of objective openness. We talk about there *not being facts about what will happen;* we talk of it *being neither true nor false what will happen*, and we talk about *there being multiple ways the future could unfold.* So, if there is any sense in which people represent the future as objectively open, such that having this representation explains why they come to represent time as dynamical, then our study should find an association between people representing our world as containing objectively moving openness and representing it as a world in which time robustly passes. This is H1.

We should also find that there is an association between representing out world as containing merely subjectively moving openness and representing it as one in which does not robustly pass. This is H2. These are our core hypotheses.

In light of previous studies which probed the connection between future openness and temporal representation, we also predicted that most people would represent our world as containing objectively moving openness (Latham and Miller 2023, Hodroj, Latham and Miller forthcoming; Hodroj, Latham, Lee-Tory and Miller 2023). This is H3.

Likewise, considering previous studies on people’s representations of time (Latham, Miller and Norton 2020a, 2021a 2021b) we predicted that most people would represent our world as one in which time robustly passes. This is H4.

We aim to determine if the associations predicted in H1 and H2 exist. Of course, even if they do this does not show that the moving open future hypothesis is true. After all, merely correlational data does not tell us anything about the direction of causation. Perhaps the reason people come to think that there is objectively moving openness is because they believe that time robustly passes, and conditional on believing this, the idea that moving openness is *objective* is much more attractive and natural. Nevertheless, determining whether the pair of associations obtain is an important first step in the project of investigating this hypothesis. Moreover, if we will fail to find the predicted associations then this would suggest that the moving open future hypothesis is likely false.

**3. Methodology and Results**

**3.1 Methodology**

*3.2.1 Participants*

1062 people participated in the study. Participants were U.S. residents, recruited and tested online using Amazon Mechanical Turk, and compensated $1 for approximately for their time. Given recent worries about the quality of data collected through MTurk, concerning both the quality of human responders and the presence of bots, we adopted several quality controls.[[16]](#footnote-16) First, we used only those MTurk participants who have a HIT (task) approval rate of at least 95% and who have had their HITs (tasks) approved at least 1000 times. That means that all our participants had already successfully completed at least 1000 other studies and received at least a 95% approval rating on these tasks. Second, we included both attentional checks and comprehension checks. 954 participants had to be excluded from the analyses because they failed one of the attentional check questions, or failed to correctly answer 3 out of 4 comprehension questions for both openness vignettes or failed to correctly answer 2 out of 3 comprehension questions for both time vignettes.[[17]](#footnote-17) The remaining sample was composed of 108 participants (37 female, 1 trans/non-binary; aged 24-72 mean age 39.81 (SD = 11.73)). Ethics approval for these studies was obtained from the [blanked] Human Research Ethics Committee. Informed consent was obtained from all participants prior to testing. The survey was conducted online using Qualtrics.

*3.1.2* *Materials and Procedure*

Participants first saw four vignettes. The first pair (openness vignettes) describe a world where which events are objectively open/fixed changes, and the second describes a world where which events are subjectively (but not objectively) open/fixed changes. The second pair (time vignettes) describe a dynamical world (i.e. a world where time robustly passes) and a block universe world (where time does not robustly pass). After seeing each pair of vignettes participants responded to several comprehension questions. The order of the vignettes, and whether people saw the time or openness vignettes first was counterbalanced across participants.

Universe A: Objectively Open Future

A close-up of a document

Description automatically generated with low confidence

Universe B: Subjectively Open Future

A screenshot of a computer

Description automatically generated with low confidence

After reading **each** openness vignette participants responded to four comprehension questions to which they could either respond (a) true or (b) false. Each question and associated response options were presented in random order.

1. Past events are fixed, but future events are not.
2. In universe [A/B] there is, now, already a fact of the matter what will happen in the future.
3. It only *appears* as if the future is not fixed because we do not know what will happen in the future in the way we know what happened in the past.
4. The past and future are both fixed, but the future does not seem to be fixed.

Participants who did not correctly answer 3 out of 4 of these questions for each openness vignette were excluded from the analyses.

Participants were then asked, “Which universe do you think is most like our universe?” and given two options (a) Universe A or (b) Universe B.

Participants then saw the two time vignettes, which were altered versions of those used by Latham, Miller and Norton (2021a).

Universe C: Dynamical

**A screenshot of a computer

Description automatically generated with medium confidence**

Universe D: Non-Dynamical

**A screenshot of a computer

Description automatically generated with medium confidence**

After reading **each** time vignette participants responded to 3 comprehension questions to which they could respond (a) true or (b) force.

1. In Universe [C/D] other times are like other places.
2. In Universe [C/D] there is an objective fact as to which events are present.
3. In Universe [C/D] events are always past or future relative to other events.

Participants who did not correctly answer 2 out of 3 of these questions for each time vignette were excluded from the analyses.

Participants were then asked, “Which universe do you think is most like our universe?” and given two options (a) Universe C and (b) Universe D.

* + 1. *Results*

Before reporting the statistics, let’s begin by summarising our main findings. We hypothesised that we would find evidence in favour of the objectively moving openness hypothesis. Specifically, we hypothesised that (H1) there will be an association between judging that our world is objectively open and judging that it is dynamical. We also hypothesised (H2) that there will be an association between judging that our world is subjectively open and judging that it is non-dynamical. These hypotheses were not supported. There was no significant association between participants’ judgements of which openness vignette (objective vs subjective) they think is more like our universe, and which time vignette (dynamic vs static) is more like our universe. We also hypothesised (H3) that most people would judge our world to be objectively open. This hypothesis was supported. Finally, we hypothesised (H4) that most people would judge that our world is dynamical rather than non-dynamical. This hypothesis was also supported.

We conducted a chi-square test of independence to test H1 and H2. That is, we tested whether a) there is an association between thinking that our world in objectively open and thinking that it is dynamical, and b) there was an association between thinking our world is subjectively open and thinking it is non-dynamical. This association was not significant, χ2(1, *N* = 108)= .320, *p* = .572. Table 1 summaries the descriptive data of participants’ judgments regarding whether our world is objectively or subjectively open, and whether it is dynamical or non-dynamical.

*Table 1. Participants judgments regarding which openness and time vignettes are most like our world.*

|  |  |  |
| --- | --- | --- |
| **World** | **Dynamic** | **Non-Dynamic (Static)** |
| **Objectively Open** | (48) 44.4% | (23) 21.3% |
| **Subjectively Open** | (23) 21.3% | (14) 13.0% |

Separate one-way chi-square tests were performed to test whether a) most participants judge our world to be objectively open rather than subjectively open and b) most participants judge our world to be dynamical rather than non-dynamical. The tests indicated that both hypotheses were vindicated. We found that a) 65.7% of participants judged our world to be objectively open (71, χ2(1, *N* = 108)= 10.704, *p* = <0.001), and also b) the same percentage of participants (65.7%) judged our world to be dynamical, (71, χ2(1, *N* = 108)= 10.704, *p* = <0.001).

**5. Discussion**

There are several notable aspects of our results. First, and most obviously, we did not find either of the predicted associations. Hence, we found no evidence in favour of the moving open future hypothesis. Our results, here, are consistent with those of previous students, which found no association between people representing our world to be *deliberatively* open, and representing it to be dynamical by being a growing block world, (Latham and Miller 2023) or between representing the future to be *nomically* open, and representing it to be dynamical by being a growing block (Hodroj, Latham and Miller forthcoming) or between representing the future to be *alethically* open, and representing to be dynamical by being a growing block world (Hodroj, Latham, Lee-Tory and Miller 2023).

Importantly, our results go beyond these results in several ways. Each of these studies probes the connection between a particular *kind* of future openness and a particular *kind* of dynamical representation, to wit, a growing block representation.

Firstly, as we noted in Section 2, some of these prior studies, such as that of Latham and Miller, may not probe people’s representations of the movement of *objective* openness at all (and indeed, were not developed to do so). As such, these studies do not speak to the hypothesis with which this paper is concerned. Moreover, insofar as they do probe moving objective openness, each of them only probes a certain *kind* of moving objective openness. It might, however, be that the relevant representation of the future as objectively open corresponds to none of these kinds, singly. Thus, the results of these studies leave it open that there is a thicker representation of objective openness which people have, and that that representation does explain why people represent time as dynamical. That is why in this study our description of objective openness is deliberately much broader and includes a range of descriptions of different kinds of objective openness.

Secondly, all the existing studies in this area probe the connection between future openness and a particular *kind* of dynamical representation: a growing block representation. However, if we want to know whether there is an association between representing time as dynamical, and representing the future as objectively open, we want to present people with more neutral vignettes as regards the kind of dynamism in question. That is because while we know that many people who represent time as dynamical represent our world as a growing block, plenty of others do not (Latham, Miller and Norton 2021). So, it could even be that there is a connection between representing the future as objectively open and representing time as dynamical in these *other* ways, even if there is no connection between representing the future as objectively open and representing our world as a growing block. Our study deliberately presented participants with more generic vignettes that describe dynamical (or non-dynamical) worlds but do not specify whether the world is a growing block, or moving spotlight, or presentist (or whatever else) world.

Given these two differences between our study and these previous studies, ours had a better chance of determining whether there is any association between representing the future being objectively open in some appropriately thick sense, and representing time as dynamical. It is very notable, then, that despite this we still found no such association.

Our study, in conjunction with previous ones, suggests that this sort of objective open future explanation, to which the deflationist might have appealed, fails to find any empirical support.

The fact that we failed to find evidence in favour of this kind of explanation of why people represent time as dynamical suggests two things. First, deflationists should further investigate the temporally aperspectival hypothesis. To test that hypothesis, we would need a clear articulation of which additional factor, or factors, in conjunction with the presence of the relevant perceptual states, explains why many, but not all, people represent time as dynamical. This investigation could certainly begin with the version of the hypothesis that we outlined earlier, which appeals to the role of passage-friendly expressions. It would be possible to determine whether people who represent time as dynamical are more inclined to employ passage-friendly expressions than are those who represent time as static. If so, this would provide weak evidence that the presence of relatively more of these expressions, alongside changing temporally aperspectival perceptions, explains why people represent time as dynamical. This evidence would be weak since we would expect people who represent time as dynamical to employ more passage-friendly expressions than those who represent time as static, and, indeed, the direction of causation might plausibly go the other way around: from representing time as dynamical to the use of passage-friendly expressions. Given this, it would also be useful to develop and empirically investigate other versions of the temporally aperspectival hypothesis on which other factors, in conjunction with having the relevant perceptual states, jointly explain why some people represent time as dynamical and others not.

Without, at this stage, being able to present an explanation of why many people represent time as dynamical, the deflationist might be thought to be at a disadvantage compared to the passage illusionist. But, we think, that is not true. The passage illusionist has a ready account of why most people represent time as dynamical; namely because this is how it seems to them to be, in perception. But they will have a harder time explaining why such a substantial minority represent time as static. After all, if time seems to us to be dynamical in experience, and if that experience is fairly universal (as we would expect given that these are low level perceptual experiences, and also, given that this is what passage illusionists assume to be the case) then why does everyone not represent time as dynamical?

Given this, we think that *both* parties need to focus on the differences between people who represent time as dynamical, and those who represent it as static. Deflationists need to explain why so many people represent time as dynamical. If they do so by appealing, in part, to certain features of perceptual experience (albeit not experiences as of robust passage, but perhaps experiences that might be misdescribed or misunderstood to be thus), then they will then need to appeal to some further factor to explain why some people do not represent time in that manner. Likewise, while passage illusionists can easily appeal to features of perceptual experience to explain why people represent time as dynamical (since they think those experiences have content as of robust passage) this too cannot be the full story, since they still need to explain why so many people do *not* represent time that way. In this regard, we see both views as on an equal footing in the explanatory stakes. Both need to find some further ingredient that explains the difference between people who represent time as dynamical, and those who represent it as static. We think this is where research could most productively be targeted now.

One general strategy we might use to explain the difference between people who represent time as dynamical and those who represent it as static, is in terms of a developmental story. For instance, one might hypothesise that children represent time as dynamical, but that as people develop some come to learn that time is in fact static, and as a result they come to represent it as such. This sort of picture would be an elegant one for the illusionist. One problem, though, is that the results of Latham, Miller and Norton (2021) seem to undermine that idea, since they found that education and knowledge of science was not associated with representing time as static vs dynamical.

Another hypothesis is that children represent time as static, and later many come to represent it as dynamical as a function (perhaps) of using passage-friendly language or other temporally perspectival language. This explanation, if true, would tend to support a deflationist view.

Thus, determining the developmental trajectory of people’s representation of time would be a useful avenue of investigation that might both shed light on why it is that some people represent time as dynamical and some as static and, in turn, provide resources to better evaluate the relative plausibility of deflationism and illusionism.

Now of course, there are limitations to studies such as the one we undertook here. One might worry that vignettes describing dynamical versus static worlds, and open vs fixed worlds, are difficult to understand, which is indeed reflected in the high drop off of participants who failed one or more of the comprehension tests. Given this, it would be well worth conducting follow up work that uses other methods to probe people’s representations of time and the future. A natural thought would be to try and use diagrams (perhaps animated ones) to capture the difference between dynamical and static time, and between the open and fixed future.

Having said that, while we failed to find an association between people representing the future as objectively open and representing time as dynamical, we did find support for our remaining two hypotheses. In each case this amounts to a (partial) replication of earlier findings, and so goes some way towards alleviating worries about participants’ comprehension.

First, consider H4, in which we predicted that most people would represent time as dynamical. Our results here are consistent with several previous studies. We found that ~65% of people judge that our world is dynamical as opposed to static. The vignettes we used, here, are quite different from those used by Latham Miller and Norton (2021a, 2021b, 2020a) who used more detailed vignettes that captured different varieties of dynamical and static views of time. Interestingly, while they found that which kind of dynamical or static view people thought was most like our world was not very stable across experiments, whether people judged our world to be dynamical or not was. They found robust findings of ~70% of people judging that some kind of dynamical world is most like our world. We replicated something very close to that finding here, using very different vignettes that focussed entirely on whether a world is dynamical or static, rather than on which kind of dynamical/static world it is. In addition, a recent study by Baron, Everett, Latham, Miller, Tierney and Oh (2023) probed people’s representations of time using animated diagrams rather than vignettes. They found that ~75% of people thought that a dynamical diagram was most like our world, and ~25% thought that a static diagram was most like our world. Taken jointly, we think these studies should give us some confidence that ~70% of people or thereabouts represent time as dynamical, and ~30% as static and, in turn, should give us some confidence that we would have found the predicted association using this methodology had there been one to find.

That brings us to the last interesting aspect of our results, which is the support we found for H3. Most people did represent the future to be objectively open. We found that ~65% of people represent the future as objectively open, with ~35% representing it as merely subjectively open. This work serves as an important partial replication of earlier work in this area. Hodroj, Latham, Lee-Tory and Miller (2023) found that ~66% of people represent the future as *alethically* open rather than closed, and Hodroj, Latham and Miller (forthcoming) found that ~60% of people represent the future as nomically open rather than closed. In our study ~65% of people represented the future as objectively rather than subjectively open. Our results, then, are consistent with those of the previous two studies regarding the percentage of people who represent the future as nomically or alethically open.

Taken together, these three studies, alongside that of Latham and Miller (2023), paint an interesting picture of people’s representation of future openness. Latham and Miller (2023) found that ~87% of people represent the future as deliberatively open. This suggests that if we want to model future openness in a way that is sensitive to people’s ordinary representations of future openness (though perhaps we do not) then focussing on deliberative openness will be especially important. For while almost all people represent the future to be deliberatively open, a substantial minority of people represent the future as nomically and/or alethically closed. Indeed, one important take away from this study is that while most people do think that the future as objectively open, there is a very substantial minority who think it is merely subjectively open. The idea, then, that certain models of time or the future are required to capture our ordinary notion of future openness (models that include future branching, or future indeterminism, or future unsettledness) may simply prove to be false, at least for a substantial minority of people. This is worth bearing in mind when theorising about the open future.

Finally, it is worth noting several limitations of our studies. One might worry that the vignettes were too cognitively demanding for non-philosophers to understand. We excluded many participants for failing attention checks or comprehension checks. These are both important because they help to weed our bots, and people selecting answers at random and without thought to quickly receive payment (Ahler, Roush, and Sood 2020). This is something that needs to be especially guarded against when running online studies and can result in large numbers of participant exclusions, as it did in our studies . However, in the context of experimental philosophy studies that attempt to include rigorous comprehension check questions, such numbers are not out of the ordinary. For instance, Bruno and Nichols (2010) included a single comprehension check question when evaluating personal identity judgments in an undergraduate philosophy class at the University of Arizona and reported that 33% and 44% of students counted as failing to adequately understand the thought experiments. More recently, Nadelhoffer, Murray, and Dykhuis (forthcoming) attempted to determine what level of comprehension there is amongst participants who read a vignette describing determinism (with a view to later making judgements about free will). They found that 81% of participants failed to correctly understand determinism. It seems safe to assume that studies that require participants to understand more complicated philosophical ideas will require substantial comprehension checks, and should also be expected to result in a high drop off in participants, which is what we found.

Still, even if we succeeded in weeding out people who did not understand the vignettes, one might worry, the resulting samples are not representative of the general population. As we see it, this is a general worry for any experimental philosophy of this kind. It is certainly possible that this is so, and it should be borne in mind when thinking about the implications of these results for further theorising. *Perhaps* people that pass the comprehension questions are more thoughtful, reflective, or intelligent, than those who did not. And perhaps these people respond differently to the questions we asked than would those who are less reflective. We see no particular reason to suppose this to be so, but we grant that it might be. Given this, some caution should be used in interpreting the results of this study, and further work in this area would be fruitful. Still, we think these results are interesting as they stand.

Finally, it is worth noting that our results might only generalise to the population sampled, namely US residents. That population, of course, is itself quite culturally heterogenous. It is important to bear in mind that our results are consistent with it being the case that both cultural and linguistic background are important factors in explaining one or both of people’s representations regarding the future, and time. What matters, for our current purposes, however, is that we used the same population to probe both kinds of representations, and the connections between them. Thus, even if cultural and linguistic factors are relevant, we would still expect to find the associations predict, if the moving open future hypothesis were correct. Moreover, and interestingly, we did not find any association between participant demographics and their responses in this study. Having said that, We do think, however, that future research could profitably look at the role of these cultural and linguistic factors regarding *both* kinds of representations. Indeed, as we noted earlier, several hypotheses regarding why many people come to believe that time robustly passes, focus on the role of passage-friendly language. Further work that targets different linguistic groups to see whether there is a difference in the prevalence of that group across linguistic groups would be useful in starting the project of evaluating the role of language in forming beliefs about whether time robustly passes.

Conclusion

Most people represent time as dynamical (though a substantial minority represent it as static) and most people represent the future as objectively open (though a substantial minority represent it as merely subjectively open). We failed to find, however, any association between the two of these, and thus no reason to think that the reason people represent time as dynamical is because they represent it as objectively open, and then represent that this objective openness moves. This leaves the deflationist in need of an explanation of why it is that so many people represent time as dynamical, given that according to deflationists it does not seem to them to be so, in perceptual experience. Having said that, the passage illusionist also faces an explanatory challenge: namely, explaining why it is that so many people represent time as static (a substantial minority) given that, according to the illusionist, it seems to them in perceptual experience as though time robustly passes. We think that future work that attempts to determine why some people represent time as dynamical, and others as static, could profitably shed light on these questions.

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1. A-theorists include Bourne (2006); Broad (1923; 1938); Cameron (2015); Craig (2000); Zimmerman (2005); Skow (2015); Smith (1993); Sullivan (2012); Tallant (2012); Tooley (1997). [↑](#footnote-ref-1)
2. We use the term ‘robust’ distinguish this kind of temporal passage from what Skow (2015) calls anodyne or anemic passage, which is the kind of temporal passage that some B-theorists endorse, and which consists (roughly speaking) in succession. See Oaklander (2015) Deng (2013, 2018) and Leininger (2021) who defend views of this kind. [↑](#footnote-ref-2)
3. Oaklander (2012), Mellor (1998); Le Poidevin (2007), Price (1996) and Farr (2012, 2020a, 2020b). [↑](#footnote-ref-3)
4. This view is often known simply as phenomenal illusionism (see Baron, Cusbert Farr, Kon and Miller (2015) and Miller, Holcombe and Latham (2018). However, since one can be a phenomenal illusionist about contents other than robust passage, we call this view passage illusionism. Hoerl (2014) refers to this view as an error theory. Le Poidevin (2007), Paul (2010), Dainton (2011, 2012), and Hohwy, Paton, and Palmer (2015) are all passage illusionists. It remains unclear whether other non-dynamists such as Norton (2010) and Savitt (1996) are rightly characterized as passage illusionists or not. [↑](#footnote-ref-4)
5. Prosser also argues that even if there were robust passage, we could not have experiences of it because its presence would make no difference. For consideration of arguments such as these see also Price (1996) Miller and Loo (2017) and Miller (2017). [↑](#footnote-ref-5)
6. Deflationism (versions of) has been defended by Deng (2013), Bardon (2013), Hoerl (2014), Braddon-Mitchell (2013), Ismael (2012), Frischhut (2015), Miller, Holcombe and Latham (2020), Miller (2019), Miller (2022), and Latham, Miller and Norton (2020b). [↑](#footnote-ref-6)
7. See Prosser (2016), Hoerl (2014), Miller, Holcombe and Latham (2018), Miller (2019), and Miller (2022). [↑](#footnote-ref-7)
8. See Latham, Miller and Norton (2020, 2021) and Latham and Miller (2021, 2021b). [↑](#footnote-ref-8)
9. It remains an open question the extent to which this generalises to all people. Though for recent corroborating evidence using a sample outside of the USA or UK see Graziani, Orilia, Capitani & Burron (2023). [↑](#footnote-ref-9)
10. These explanations are not mutually exclusive, and so both might play a role. [↑](#footnote-ref-10)
11. Of course, the passage illusionist appears to have an easy explanation here. She can say that we come to represent time as robustly passing because this is how things seem to us perceptually, even though this is in fact a perceptual illusion. The *passage realist* can say something similar: we come to have this belief because it seems to us, in perception as though time robustly passes. What is more, the passage realist will say that this seeming is veridical. See, for example, Smith (1993) and Schlesinger (1980, 1991, 1994) [↑](#footnote-ref-11)
12. Arguably, Balashov (2005) has a similar view. [↑](#footnote-ref-12)
13. Hohwy, Paton and Palmer (2016) have a view that is a little similar to this, though they describe it as one on which it seems to us as though time flows (and hence it might be best thought of as a view on which it seems to us as though time robustly passes) and it seems this way in virtue of the ways in which our perceptual systems predict what we will experience (thus “pushing” us into the future) and that prediction is then either verified or not when by the data our perceptual systems collects. Sattig, however, takes his account to be one in which it does not seem to us though time robustly passes. [↑](#footnote-ref-13)
14. See Briggs and Forbes (2012), Forbes (2016), Grandjean (2019), Rosenkrantz and Correia (2018). [↑](#footnote-ref-14)
15. Which is of course correct. Latham and Miller (2023) note that while in fact, future nomic indeterminacy does not entail that future events do not exist, and is in fact consistent with a block universe world, they nevertheless hypothesised that non-philosophers would believe that for there to be nomic indeterminacy it would need to be the case that future events do not exist. This hypothesis was not borne out. [↑](#footnote-ref-15)
16. See Ahler, Roush & Soud (2019) for a discussion of some of the problems associated with collecting data using MTurk and the prevalence thereof. [↑](#footnote-ref-16)
17. Rerunning our analyses with only participants that answer every comprehension question correctly does *not* change any of our reported results. [↑](#footnote-ref-17)