

LOCATING TEMPORAL PASSAGE IN A BLOCK WORLD

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This paper aims to determine whether we can locate temporal passage in a non-dynamical (block universe) world. In particular, we seek to determine both whether temporal passage can be located somewhere in our world if it is non-dynamical, and also to home in on *where* in such a world temporal passage can be located, if it can be located anywhere. We investigate this question by seeking to determine, across three experiments, whether the folk concept of temporal passage can be satisfied in our world if it is non-dynamical, and, if it can, what sort of thing in our world satisfies that concept. In particular, we focus on the question of whether that concept (if satisfied) is satisfied by something mind-dependent or something mind-independent. In other words, we ask, is temporal passage something that is at least partially in the mind, or is it entirely external to the mind? We find, contrary to what is often assumed by dynamists and non-dynamists alike, that the folk concept of temporal passage is satisfied in our world conditional on it being non-dynamical, and that the concept is satisfied by something mind-independent. This provides further ammunition for recent deflationary accounts of temporal passage that attempt to locate passage somewhere in our non-dynamical world.

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1. Introduction

Dynamical theories, sometimes called *A-theories*, are views according to which time robustly passes.¹ By *robust passage* we mean temporal passage that essentially involves a constant change of objective fact about which time is (or which events are) present. By contrast, non-dynamical theories are those on which time does not robustly pass. On such views (which include both B-theoretic² and C-theoretic³ views) there is no objective fact as to which time is, or which events are, present. Instead, events bear static relations of earlier-than, later-than, and simultaneous with, to one another, and ‘past’, ‘present’ and ‘future’ are relational terms that pick out the locations of some events relative to others.

Although non-dynamical models of time do not posit *robust passage*, a question nevertheless arises regarding whether or not our ordinary, or as we will say ‘folk’, concept of temporal passage is satisfied⁴ if our world turns out to be non-dynamical. Amongst philosophers who are dynamists (those who think that our world is dynamical⁵), it has typically been supposed that nothing would satisfy our folk concept of temporal passage if our world were a non-dynamical world. Presumably, this is because they hold that our folk concept of temporal passage is what we might call a *dynamical concept*: it is satisfied iff our world contains robust passage.⁶

Until recently, non-dynamists (those who think our world is non-dynamical) seemed to concede that this was so. Indeed, non-dynamical theories are often described as being ones according to which time does not pass. Recently, however, a number of non-dynamists have argued that although our world is non-dynamical, it is nevertheless the case that something in our world deserves the name ‘temporal passage’.⁷ One interpretation of these authors is that they are arguing that something like the folk concept of temporal passage is satisfied in our non-dynamical world.⁸ These authors can then be seen as taking up the question not only of *whether* our folk concept of passage is satisfied in our non-dynamical world, but also as providing an account of *what it is* in our world that satisfies that concept.

1. To distinguish this kind of temporal passage from what Skow (2015) calls anemic passage

2. See Maudlin (2007), Oaklander (2012), Mellor (1998), Le Poidevin (1991).

3. See Price (1996), Farr (2012; 2020).

4. That is, whether something falls under that concept at a world.

5. For a defense of various versions of dynamism see Cameron (2015), Tallant (2012), Tooley (1997).

6. See Smith (1994), Schlesinger (1994).

7. See Savitt (2002), Deng (2013a; 2013b; 2019), Leininger (2018; 2021), Ismael (2017), Mozersky (2015), Maudlin (2007), Dieks (2006), Oaklander (2015), Fazekas (2016), Harrington (2009).

8. We don’t claim that this is the right interpretation of all of these authors. Perhaps some are better thought of as proposing to engineer a concept of temporal passage, and arguing that the resulting concept deserves the name because what satisfies that concept plays a certain role. In turn, they then argue, that concept is satisfied in our non-dynamical world.

If it could be shown that something does indeed satisfy our concept of temporal passage in our world, conditional on its being non-dynamical, then this would put non-dynamical theories on a firmer footing. Dynamists offer various arguments for dynamism that appeal to various (purported) facts about how we think about and experience the world. Sometimes these arguments appeal to how things seem to us to be, in experience (to our temporal phenomenology).⁹ Sometimes they appeal to how we intuitively or pre-theoretically take things to be (to a certain folk concept or concepts).¹⁰

In all three cases the rough idea is that it seems to us (in some very broad sense of that term) as though our world contains robust passage, and that this is a reason to suppose it does.

A good deal of recent work in this area has focussed on the first sort of question—what we will call the *phenomenological question*—namely, on whether it really does seem to us, in experience, as though time robustly passes. Some non-dynamists have responded to such arguments by conceding that it does seem as though time robustly passes and then proceeding to explain why things seem this way even though they are not (so-called passage illusionists).¹¹ Others have denied that it does seem to us as though time robustly passes (so-called deflationists).¹²

Deflationary non-dynamists, who suppose that the relevant experience has phenomenal content (i.e., represents that the world is some particular way), usually hold that the experience veridically represents certain aspects of the non-dynamical world, and often it is thought that they represent what has become known as *anemic*¹³ *temporal passage*. Anemic passage is, very roughly, the succession of events that occurs in a non-dynamical world. That there are such deflationists might give us some reason to suspect, or at least wonder, whether the folk concept of temporal passage might be satisfied by anemic passage.

Recent attention has also been given to the question of whether we pre-theoretically represent time as dynamical¹⁴—*the representation question*. By *representation* here, we simply mean a contentful mental state. Then the representation

9. See Smith (1994), Craig (2000), Schlesinger (1994). For discussion of this kind of argument see Baron, Cusbert, Farr, Kon, and Miller (2015).

10. See for instance (arguably) McTaggart (1908), Gödel (1949), C. Williams (1998; 2003) and Zimmerman (2008). Callender (2017) also talks of the manifest image of time, and seems to think that certain aspects of this image are closer to a dynamical than a non-dynamical view of time.

11. See for instance Le Poidevin (2007) and Paul (2010). It remains unclear whether some other non-dynamists such as Norton (2010) and Savitt (1996) are rightly characterized as passage illusionists or not. Prosser (2007; 2012) is an illusionist, but he thinks the illusory state represents an enduring self rather than robust passage.

12. See Frischhut (2015), Deng (2013b; 2019), Bardon (2013), Hoerl (2014), Miller, Holcombe, and Latham (2020) and Miller (2019).

13. It has also been called *anodyne temporal passage* elsewhere. See, for example, Miller (2021).

14. See for instance Latham, Miller, and Norton (2019).

question, as we conceive of it, is the question of whether people pre-theoretically, or naively, represent time in the actual world as being dynamical. Another way to get at much the same idea is to wonder whether people (likely *tacitly*) believe that time is actually dynamical.

Finally, attention has also been given to the question of whether our *concept of time* is a concept of something that is dynamical—the *temporal concept question*.¹⁵ We will say that our concept of time is dynamical just case that concept can only be satisfied in worlds in which time robustly passes. That is, it's a concept on which something counts as being time only if that thing is dynamical.

The temporal concept question, then, targets the *content* of our *concept* of time. Though related, the representation question and the temporal concept question are distinct, and their answers can come apart in important ways. For example, one could pre-theoretically represent that time passes, and yet not have a dynamical concept of time. That will be the case if one represents actual time as dynamical but has a concept of time that can be satisfied in non-dynamical worlds. Indeed, work in these areas suggests that this is in fact the case. People do tend to represent time is dynamical (Latham, Miller & Norton 2019) but they do not have a dynamical concept of time (Latham, Miller & Norton 2020a; Latham & Miller 2020a; 2020b)

Work in this area suggests that it is time to turn our attention to the question of whether the folk concept of *temporal passage* could be satisfied in a non-dynamical world.

One reason to suspect that the folk concept of temporal passage *cannot* be satisfied in a non-dynamical world is if one thought it were the case that the folk concept of time *itself* cannot be satisfied in such a world. As just noted, however, this is not so. Recent work found that even amongst dynamists (i.e., those who represent actual time as dynamical) most hold that counterfactual non-dynamical worlds (containing B-relations) contain time (Latham, Miller & Norton 2020a).¹⁶ This opens up the possibility that our concept of temporal passage may be one that is satisfied in a non-dynamical world.

In this paper, we take up the *temporal passage concept question*: the question of whether our folk concept of temporal passage can be satisfied in a non-dynamical world. We distinguish two broad questions here. First, the question of whether our concept can be satisfied in a non-dynamical world, and, second, the question of what sort of thing satisfies that concept in such a world. Each question requires some further unpacking. With regard to the first question, we are predominantly interested in whether, if, as non-dynamists hold, our world is non-dynamical, people have a concept of temporal passage that is in fact actu-

15. Baron and Miller (2015a; 2015b), Latham, Miller, and Norton (2020a).

16. More carefully, in one experiment they found that a (significant) majority of dynamists judged this, and in the other they found that about 50% of dynamists judged this.

ally satisfied. That is, conditional on our world being non-dynamical, is people's concept of temporal passage actually satisfied? If it is, then this is sufficient to show that people do not have a dynamical concept of temporal passage, and would lend some credibility to recent non-dynamical views that try to locate temporal passage in our non-dynamical world. We also ask whether anything satisfies our concept of temporal passage in *counterfactual* non-dynamical worlds (regardless of whether the actual world is dynamical or not). This is an interesting question. For it could be that people have a sort of conditional concept of temporal passage, on which if actually our world is non-dynamical then something in our non-dynamical world satisfies that concept, *but if in fact our world is dynamical*, and hence contains robust passage, then their concept is satisfied only in worlds containing robust passage. We aim to determine whether people's concept of temporal passage is like this.

If we find that something does satisfy our concept of temporal passage in our world if it is non-dynamical, then this will indicate that what we might call 'B-passage views' are worthwhile. If so, it raises the question as to what sort of thing it is that satisfies our concept in our world if it is non-dynamical. We cannot hope fully to answer this second question, so we focus only on whether what satisfies that concept is something mind-dependent or mind-independent (more on this shortly). Answering this question will give us an indication of which *kind* of B-passage view better captures the content of our concept of temporal passage.

In answering these questions, we take ourselves to be trying to solve what is sometimes known as a *location problem*.¹⁷

Solving a location problem is the task of finding a place in our preferred theoretical ontology for some phenomenon that otherwise does not seem to have a place there. Consider the folk term 'solid'. This term does not appear in fundamental physics. We now know that tables are made up of molecules that are bound together in a certain sort of way. But this scientific fact alone doesn't tell us anything about *solidness*. In solving the location problem for solidness, the thought goes, we 'located' solidness in our physical and chemical theories. The fact that the molecules of certain objects like tables are in close proximity *entails* the fact that the table is solid, it does not replace it (Jackson 1998: 1–3).

There are several ways one might conceive of the project of solving any particular location problem.

One approach aims to solve location problems by analysing the concept that is associated with the term or expression in question, and then determining whether anything in the world falls under (that is, satisfies) that concept.¹⁸

17. See Jackson (1998).

18. This is sometimes known as the Canberra Plan. See for instance Jackson (1998), Braddon-Mitchell (2009), Chalmers (2006).

On this view we first investigate the concept of temporal passage (most likely by investigating the conditions under which we take the concept to be satisfied) and we see if anything in our world satisfies that concept (given that our world is non-dynamical).

It is this strategy we employ. Many, of course, think that determining whether a term/expression refers, and if so to what, does not go via any consideration of our concepts. Semantic externalists hold that we simply look directly to the world itself to see whether, say, ‘temporal passage’ refers without interrogating our (folk) concept of passage.¹⁹ Notably though, even externalists hold that folk concepts (or something similar) play a subject-setting or reference-fixing role. This role is not semantic, it’s not part of the meaning of the terms; it is meta-semantic: it is the thing that allows us to pick out samples in the world whose nature we can investigate, in order to determine what it is to which the term in question refers. In order to know *whether* ‘temporal passage’ refers (even if it’s a semantically externalist matter *to what* it refers), if our world is non-dynamical, then, we need to know something about the content of what plays this meta-semantic role. In what follows we can be seen as taking on this question by seeking to ascertain something about the content of the folk concept of temporal passage, though we will often frame matters in terms of the former, rather than the latter, approach to solving the location problem.

We begin, in Section 2, by outlining relevant research in this area. In Section 3 we outline our methodology for several experiments, and in Section 4 we discuss our results.

2. Background to the Question

The idea that we can locate temporal passage in our world even on the assumption that it is non-dynamical has been defended by a number of authors.²⁰ These authors not only seek to answer the question: ‘is there temporal passage in our non-dynamical world?’ with a ‘yes’, but they also seek to *locate* temporal passage in our world. As such, we can use these accounts to inform our theorising about where we should try to locate something that satisfies the folk concept of temporal passage in our non-dynamical world, assuming something does. Before we turn to these accounts, though, several clarifications are in order.

Firstly, what exactly do we mean by ‘concept’? Different people in the literature mean different things by concept—some think they are Fregean senses, others think they are mental representations. In this paper we have something

19. See for instance Kripke (1980), Soames (2002), Salmon (1981).

20. See for instance Savitt (2002), Deng (2013a; 2013b; 2019) and Leininger (2018; 2021).

more like a Fregean view of concepts in mind: we assume that there is a tight connection between the expression 'temporal passage' and our concept of temporal passage, such that the latter is satisfied iff the former refers (and is satisfied by whatever it is that the expression refers to). We also assume a broadly internalist view of concepts.²¹ We assume that what people are (perhaps tacitly) disposed to judge about the circumstances under which a concept is satisfied (or not) provides defeasible evidence about the content of that concept. (One might also think that those dispositions exhaust the content of the concept, but nothing we say relies on this being so). Hence, we do not assume that people are, in general, able to articulate the necessary and sufficient conditions for their concept to be satisfied (that is, to provide an analysis of the concept). We only suppose that people are able to *use* their concepts. So our experimental methodology aims to determine whether or not the folk concept of temporal passage is satisfied (and by what) in various scenarios by getting participants to use their concept in those scenarios. Further, we suppose that what people say about whether their concept is satisfied when they consider a certain scenario is defeasible evidence regarding the content of their concept. We consider this defeasible evidence because, for all we know, what people *say* they would say in that scenario, and what they would *in fact* say, might come apart.

Secondly, who exactly do we mean by 'the folk'? That is, whose concept of temporal passage are we investigating? There are cultural differences in the way people think about time.²² That is, there is some evidence suggesting that different populations have different concepts in regard to time, or, at least, make different theoretical assumptions.²³ Additionally, it is known that the way we speak, write, and read about time is connected to the way we conceptualise and represent time²⁴ and that there are cross-cultural differences in regards to the gestures that are used to convey information about time.²⁵ It remains controversial whether this reflects a deep difference in the way we represent time, or merely a difference in the way we communicate.²⁶

We will not take a stand on these issues. Our data is drawn from U.S. residents. So we can only speak to the question of whether the population from which our sample is drawn, is such that it has a concept of temporal passage that

21. See Jackson (1998; 2004; 2007; 2009), Chalmers (2004), Braddon-Mitchell (2004a; 2004b; 2005; 2009), Pettit (2004) for defences of this kind of internalism.

22. Although there is disagreement concerning the extent to which this is the case (see, for example, Nagel et al. 2013; Kim and Yuan 2015; Seyedsayamdost 2015).

23. See Stich (1990), Weinberg et al. (2001), Machery et al. (2004), Buckwalter and Stich (2014).

24. Boroditsky (2001), Boroditsky, Fuhrman, and McCormick (2011). See also Fuhrman and Boroditsky (2010), Casasanto and Bottini (2014).

25. Núñez et al. (2012).

26. Callender (2017) has argued that the folk view of time does not differ very substantially across cultures.

can be satisfied in a non-dynamical world. Similar results may be attained from other populations, but we cannot speak to this issue.

Further, we do not assume that all of our participants (or the population from which they are drawn) share the same folk concept of temporal passage. They may not. Their concepts may differ in ways that our studies do not detect. Indeed, our studies do not aim to reveal the entire content of the folk concept, or concepts, of temporal passage. That is a job that is beyond the scope of this paper. We aim to ascertain whether participants have a folk concept of temporal passage that is satisfied in our world, if it is non-dynamical, and hence whether some B-passage view can be supported by appealing to the folk concept of temporal passage. We also aim to ascertain whether people have a folk concept of temporal passage that is satisfied in a counterfactual non-dynamical world; hence we aim to shed some light on whether that concept is a conditional concept. The concept of temporal passage is a conditional concept²⁷ if it is satisfied only in worlds containing robust passage, *conditional on our world in fact containing robust passage*, and is otherwise satisfied by something like anemic passage.²⁸ We also aim to ascertain whether what satisfies the folk concept of temporal passage in the actual non-dynamical world (assuming something does) is something entirely mind-independent, or something mind-dependent (more on this below too). This will leave unexplored many aspects of the content of the folk concept of temporal passage.

Many philosophers have thought that dynamical theories of time best align with our folk views on this matter.²⁹ Until recently there was little experimental work that sought to evaluate this claim. Recent work, however, has focussed on relevant phenomenological, representational, and conceptual questions.

Latham, Miller, and Norton (2019) sought to answer the representational question: do the folk represent time as dynamical? They found that ~70% of participants were dynamists. While interesting, even if most people are dynamists, this tells us nothing about whether the folk concept of passage can be satisfied in our world if it is non-dynamical. That is because even if most people represent time as dynamical—that is, even if most people *think* that time in the actual world is dynamical—it might still be that their concept of time is not dynamical, because that concept will be satisfied if it should turn out that our world is (contrary to what they suppose) non-dynamical.

Relatedly, Latham, Miller, and Norton (2020a) explored the question of whether our concept of time is dynamical: that is, whether it is a concept that is *only* satisfied in a dynamical world. Interestingly, they found that this was

27. See, for instance, Braddon-Mitchell (2004a), Hawthorne (2002).

28. In general, conditional concepts are those which are such that what satisfies them in counterfactual worlds depends on what satisfies them actually.

29. See Smart (1949), Norton (2010) and Callender (2017).

not the case. While most people think our world is dynamical, they still judge both that if our world *is* non-dynamical (contrary to what they suppose) then it contains time, and they also judge that counterfactual non-dynamical worlds contain time. This finding is *consistent* with the folk concept of temporal passage being satisfied if our world is non-dynamical, but does not tell us whether this is so. After all, even if people are inclined to judge that non-dynamical worlds contain *time*, they may not judge that non-dynamical worlds (including our own) contain *temporal passage*. For, quite clearly, someone might judge that a world contains time without containing temporal passage, if they do not take it to be essential to time that time passes. Thus it could be that people judge that if our world is non-dynamical it contains time, but not temporal passage, and indeed this is what most non-dynamists have probably supposed to be the case.

Finally, Latham, Miller, and Norton (2020b), and Shardlow, Lee, Hoerl, McCormack, Burns, and Fernandes (2021) attempt to answer the phenomenological question by determining whether it seems to people as though time robustly passes. While both studies find roughly the same results, the two sets of authors draw somewhat different conclusions from that data, with Latham et al. concluding that it does not seem this way, and Shardlow et al. concluding that it does.

However, determining the content of this experience does not automatically answer our conceptual question. Of course, there might be important connections between these two questions. For instance, our concept of temporal passage might be a concept that is satisfied iff ‘things are like *this*’ where the ‘*this*’ demonstratively points to a particular temporal experience (namely the one whose content is disputed).

But at this point we have no reason to think this is so. It could be, for instance, that we have a phenomenology that represents that time robustly passes, (that is, it could be that it seems to us in experience as though time robustly passes) and it could also be that we represent time as dynamical (that is, it could be that we represent that in our world there is robust passage). And yet it could *still* be that our concept of temporal passage will be satisfied if our world is, (pace our representation of it) non-dynamical. This will be the case if we judge that counterfactual non-dynamical worlds contain temporal passage, or if we judge that if our world is in fact non-dynamical (contrary to what we suppose) then it contains temporal passage. Compare: we might once have *represented* dolphins as being fish, and we might even have had phenomenology whose content was *as of* dolphins being fish (we are not suggesting this is true, but let’s suppose it was) and yet our concept of dolphin be one in which that concept will still be satisfied even if it’s discovered that the grey guys in the water with fins are in fact mammals.

That is why, in what follows, we aim to directly answer the temporal passage concept question rather than going via investigation of our phenomenology or other aspects of our representation of actual time.

So how might we go about determining whether the folk concept of passage is satisfied in a world? We suppose that the satisfaction of the folk concept is intimately tied to a range of sorts of everyday descriptions being true. One of these, and the most minimal at that, is that the expression ‘time passes’ is taken to be true at a world. Given this, several of our experiments probe whether the folk concept is satisfied, by probing whether people are inclined to judge that ‘time passes’ is true at certain worlds.

Even if we find that people are inclined to make that judgement, however, one might think that in order for the concept to be satisfied, more is required; namely, people must also judge that a range of other sorts of descriptions—the sorts of descriptions that philosophers typically associate with temporal passage—are true at a world. That is because you might think that there is some trivial sense of ‘time passes’ in which we can all agree that time passes even in non-dynamical worlds: namely the sense in which clocks measure elapsed time. But this is, presumably, not the sense of time passing that is at issue, or at least, it’s not entirely what is at issue. Rather, what is at issue is whether in some ‘thicker’ sense, time passes in non-dynamical worlds.

In our first experiment we begin simply by probing whether people are inclined to judge that ‘time passes’ in various scenarios. Then in experiment 2 we present them with ‘thicker’ descriptions associated with temporal passage, to see whether people judge that these descriptions can be true in non-dynamical worlds.

We begin, in experiment 1(a) by presenting participants with a vignette that describes a non-dynamical world. Then we ask participants to imagine that it has been discovered that our world is just like this world. We then ask participants whether time passes in the world in question. This is a proxy for asking whether, if our world is non-dynamical, time passes in our world. We hypothesised:³⁰

H1: People will judge that time passes in the non-dynamical world that is stipulated to be just like our world.

If H1 is supported this tells us that people judge that time passes in our world if it is non-dynamical. Thus, the vindication of H1 provides support for a B-passage view.

In experiment 1(b) we present participants with four vignettes that describe three dynamical worlds and one non-dynamical world. We then ask partici-

30. Our experimental hypotheses, materials and data can be found at <https://osf.io/4t3cn/>.

pants which of these worlds participants think is like the actual world, as well as whether time passes in that world. Participants who report that they think the actual world is like one of the three dynamical worlds are then asked whether time passes in the non-dynamical world. Since previous empirical work found no evidence that people's concept of *time* is conditional (see Latham, Miller, & Norton 2020a), we hypothesised:

H₂: People will judge that time passes in a counterfactual non-dynamical world, and will make that judgement regardless of whether they judged the actual world to be dynamical or not.

If H₂ is supported then this provides further, even stronger, evidence in favour of a B-passage view. For it tells us that even those who think that our world is dynamical judge that there is temporal passage in counterfactual non-dynamical worlds. This rules out, for instance, that the reason some people judge that there is temporal passage in our world if actually time is non-dynamical, is because they are failing to really take on board the stipulation about our world, and are still imagining it as dynamical. If H₂ is supported then this also provides evidence regarding whether people's concept of temporal passage is a conditional one: namely, it suggests that it is not. That is because this experiment allows us to see whether there is a difference in people's judgments about whether time passes in these worlds and whether that difference is a function of whether or not people think that the actual world is dynamical. If it is a function of this, then this is a reason to think that their concept is conditional. If people have a conditional concept we would expect that non-dynamists will judge that time passes in the counterfactual non-dynamical world, while dynamists will tend to say that it does not.

Importantly, the truth or falsity of H₁ is independent of that of H₂. Even if H₂ is false because people *do* have a conditional concept of temporal passage this is consistent with people judging that if actually our world is non-dynamical, that it contains temporal passage. That will be the case if, regardless of whether they think that our world is in fact dynamical, people tend to judge that *our world will count as containing temporal passage if it is non-dynamical*.

One way to put this is that if H₁ and H₂ are both supported, then people have an unconditional concept of temporal passage that is satisfied in any world (actual or otherwise) that is non-dynamical. By contrast, if H₁ is supported but H₂ is not, then this will be because people have a conditional concept of temporal passage. That concept will be actually satisfied if our world is non-dynamical, and will then be satisfied in any counterfactual non-dynamical worlds, but will only be satisfied in *counterfactual* non-dynamical worlds conditional on our world being non-dynamical.

We also hypothesised:

H3: Non-dynamists will be more inclined to judge that time passes in the counterfactual non-dynamical world than will dynamists.

We made this prediction because we think it plausible that believing that our world is dynamical is more likely to be associated with judging that a counterfactual non-dynamical world fails to contain temporal passage, than judging that our world is non-dynamical. This will certainly be so if H2 is not supported, and people have a conditional concept of temporal passage. For then those who judge our world to be dynamical will judge that the counterfactual non-dynamical world does not contain temporal passage. Again though, and importantly, finding support for H3 is consistent with finding support for H1. Even if dynamists are less inclined to judge that time passes in the counterfactual non-dynamical world than are non-dynamists, this is consistent with them judging that time passes in *our* world, if it is non-dynamical, and hence consistent with H1 being vindicated.

That brings us to experiment 2. Here, we focus on a broader range of expressions that philosophers take to be associated with the concept of temporal passage, in order to rule out that when people judge that ‘time passes’ in the vignettes used in experiment 1 they may be tracking an entirely trivial sense of temporal passage.

To do so we generated a vignette we call ‘the description’ which included a range of such expressions. Participants were split into two conditions, one that saw a dynamical world (dynamical condition) and one that saw a non-dynamical world (non-dynamical condition). Participants in each condition were then asked whether, if they were told that the description was of the dynamical or non-dynamical world respectively, they would judge that what they were told is true. We hypothesised:

H4: People will judge that what they were told (i.e., that the description is of the dynamical/non-dynamical world) is true in both the dynamical and non-dynamical condition.

We would expect that if H4 is supported, then so is H1. For we would expect that if people judge that the description is true in the non-dynamical world, where that world is not specified to be actual, then they would judge that time passes in the actual world if it is non-dynamical. Likewise, we would expect that if H2 is supported, and so people do not have a conditional concept of temporal passage, then H4 will be supported. For in that case we would expect that they will judge the description to be true in both a dynamical and non-dynamical world regardless of whether it is counterfactual or not.

Further, we hypothesised:

H5: People will be more inclined to judge that what they are told is true when they are told that the description is a description of a dynamical world, than when they are told that it is of a non-dynamical world.

H5 captures the idea that our concept of temporal passage is one that is *better satisfied* by robust passage than anemic passage. Notably of course, even if H5 is supported, this is consistent with H1, H3, and H4 being supported. For it can be that robust passage better satisfies our concept of temporal passage and yet it still be the case that anemic passage satisfies it well enough for our concept to be satisfied if actually our world is non-dynamical (H1, H3, H4). We might also predict that H5 will be supported if H2 is *not*. That is because if our concept of temporal passage is a conditional one, we would expect that this is because robust passage better satisfies that concept. So if our concept of passage is conditional we would expect to find support for H5, although the converse need not be the case: robust passage can better satisfy our concept of temporal passage and yet our concept not be conditional.

Finally, we wanted to speak to the question of what sort of structure is required in order for the folk concept of temporal passage to be satisfied. There are various questions one might have in this regard. One might wonder whether the presence of B-relations is sufficient for the folk concept of temporal passage to be satisfied, or whether some additional metaphysical or physical structure, such as the presence of asymmetric causal relations, asymmetric records/epistemic asymmetry, the presence of increasing entropy, or some such, is required.³¹ We do not aim to target these questions here. Rather, we are interested in the prior question of whether what satisfies the folk concept of temporal passage is something entirely mind-independent—some metaphysical structure in the world—or instead is satisfied by something mind-dependent. We call the former the mind-independent view, and the latter the mind-dependent view.

In what follows we will take something to be mind-dependent iff its existence at least partially supervenes on the existence of minds/mental states, and mind-independent otherwise.³² So if temporal passage is mind-dependent,

31. Assuming you think that the former can exist in the absence of the latter. While Savitt (2002), Deng (2013a; 2013b; 2019) and Leininger (2018; 2021) in some sense all identify temporal passage with the presence of succession (what for Deng and Savitt are really just B-relations), Leininger (2021) takes the presence of succession to be intimately connected with causality (and the light-cone structure), and it may be that many of these other authors are reductionists about B-relations, so that they take these relations to be reducible to facts about causation (Mellor 1998; Le Poidevin 1991) or the global entropic gradient (Albert 2000) rather than being primitive (Maudlin 2007; Oaklander 2012; Tegmeier 1996; 2009; 2016) and hence able to come apart from these other asymmetries.

32. Hence, we distinguish mind-dependence from response-dependence, where we take something to be response-dependent if what it is to be that thing, is to be the something that is disposed to generate certain mental states, but where that thing might be entirely mind-independent.

this leaves open that temporal passage might be identified with mental states, or with the mental states in conjunction with the appropriate metaphysical structure.³³

Leininger (2021) defends a mind-independent view. She explicitly aims to establish “a place for the mind-independence of temporal becoming in the B-theory/blockworld” (2021: 138). It is somewhat less clear whether other accounts of temporal passage in a block universe are mind-dependent or independent.

In their discussion of locating temporal passage in our world, both Deng (2013a; 2013b; 2019) and Ismael (2012; 2017) talk a lot about how we are, as creatures. On one interpretation both authors, like Leininger, identify temporal passage with something external in the world, but then appeal to facts about creatures like us to explain why we have certain experiences in a world that contains that structure. On another interpretation Ismael (2017) in particular might be seen as holding that temporal passage is mind-dependent. On this interpretation she defends the idea that temporal passage should be identified as *time from a specific temporal perspective*. On that view

time passes from the evolving point of view of an IGUS [a system that uses what it senses in its environment to navigate in that environment] in the same way that rows of houses pass by the passengers on a train. It is an illusion only if we think that it is time itself, rather than our perspective on time, that changes over a life. (Ismael 2017: 34)

Now, we don't want to get too deeply involved in interpretive matters here. So, for the purposes of illustration let's talk about Ismael*, whose views may or may not mirror the views of Ismael herself. According to Ismael*, temporal passage just consists in there being a sequence of temporally embedded perspectives, where those perspectives have a certain content: namely, they (*inter alia*) represent earlier events as past, and as being already decided, while they represent (some) later events as open to deliberation and not yet decided, and they also represent that some past events that are now decided were, earlier, open to deliberation and undecided. (It is not part of this account that the future really is ontologically open; only that as embedded agents we can and must treat cer-

33. This distinguishes mind-dependent views from what we might call mind-sensitive views and from response-dependent view. According to *response-dependent views*, temporal passage is to be identified with that mind-independent phenomenon which is disposed to create in us certain mental states. Thus, which thing in the world is temporal passage might be intimately connected to our having certain mental states, insofar as temporal passage just is that thing in the world that is disposed to create certain such mental states. But that thing in the world is nevertheless mind-*independent*. By contrast, according to mind-*sensitive* views, temporal passage is to be identified with some combination of mental states and non-mental states, and so this is a version of mind-*dependence*, though not as strong a version as one that identifies temporal passage just with mental states.

tain future states as open to deliberation and past ones as closed. Ismael* is then going to offer an account of why creatures like this evolved within a B-theoretic world). So according to this view, temporal passage is identified with a sequence of mental states. Some of those mental states are likely phenomenological, and others are intentional. According to Ismael*, our concept of temporal passage is a concept that is satisfied just when those kinds of mental states are present. So, if Ismael* is right, then people will judge that there is no temporal passage in worlds that lack mental states like that.

Our aim in experiment 3 is not to investigate any particular view about which particular mental states ought to be identified with temporal passage. Rather, it is to determine whether people are more inclined to judge that there is temporal passage in a world containing mental states of a certain sort, than one that lacks those mental states. We describe these states in fairly broad-brush strokes, with no aim of distinguishing different views one might take about which states are required. Importantly, then, in these vignettes what matters is simply whether or not the world contains creatures that have certain mental states (mind-dependent condition), or contains no such creatures (mind-independent condition)

We hypothesised:

H6: People will judge that there is temporal passage in both the mind-dependent and the mind-independent condition.

We made this prediction because we think that, most likely, people do not have a mind-dependent view of temporal passage: they will think that temporal passage exists even in worlds that lack mental states. Having said that, we thought it likely that people would be more certain that temporal passage exists in worlds that contain those mental states, and so we further hypothesised:

H7: People will be more inclined to judge that there is temporal passage in the mind-dependent condition compared to the mind-independent condition.

3. Methodology and Results

3.1. Experiment 1 Methodology

3.1.1. Participants

191 people participated in experiment 1(a). 1019 people participated in experiment 1(b). Participants in both experiments were U.S. residents, recruited and

tested online using Amazon Mechanical Turk. Participants in experiment 1(a) compensated \$0.50 for a maximum of 10 minutes of their time. Participants in experiment 1(b) were compensated \$0.75 for a maximum of 15 minutes of 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 a number of quality control measures.³⁴ 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, a standard that can be expected to eliminate most bots. Second, our study included both attentional checks and comprehension checks. We excluded participants who failed either to follow task instructions or correctly answer attentional and comprehension check questions. In experiment 1(a) 116 participants had to be excluded for failing to follow task instructions or vignette comprehension. This means that they failed to answer the questions or failed one of the attentional check questions (48) or failed to correctly answer 3 out of 4 comprehension questions (68). In experiment 1(b) 696 participants had to be excluded for failing to follow task instructions or vignette comprehension. This means that they failed to answer the questions or failed one of the attentional check questions (248) or that they failed to correctly answer 3 out of 4 comprehension questions (448). The remaining sample of experiment 1(a) was composed of 75 participants (23 female; aged 22–60, mean age 37.52 (SD = 9.42)). The remaining sample of experiment 1(b) was composed of 323 participants (135 female; aged 20–75, mean age 39.35 (SD = 11.46)). Ethics approval for these studies was obtained from the University of Sydney 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

Experiment 1(a)

Participants saw a single vignette, which is as follows:

Universe D: Non-dynamical (B-theory)

Imagine a universe (universe D) where a single set of events—such as the extinction of the dinosaurs or the launching of a ship, or the birth of a

34. See Ahler, Roush, and Soud (2020) for a discussion of some of the problems associated with collecting data using MTurk and the prevalence thereof.

baby—exist. All these events are equally real. The sum total of reality never grows or shrinks, so the totality of events that exist never changes. In this world past, present, and future events all exist. If there have ever existed dinosaurs, then dinosaurs exist somewhere in the universe. If there will ever exist sentient robots, then there exist sentient robots somewhere in the universe. In universe D other times are much like other places. Just as in our world Singapore, Sydney, and Seattle all exist, even though do they not exist in the same place in spacetime in universe D dinosaurs and robots exist, even though they do not exist at the same time. So in universe D every time is present from the perspective of those located at it, just as every place is ‘here’ from the perspective of those located at it.

For example, in universe D there is the event of Suzy throwing the ball at the window, and the event of Billy throwing the ball at the window. When Suzy throws her ball, Billy is still holding his ball; he has yet to throw it. In universe D the event of Suzy throwing her ball, and the event of Billy throwing his ball, both exist. But they do not exist at the same place in space-time: the event of Suzy’s ball hitting the window is earlier than the event of Billy’s ball hitting the window. So in universe D there is a fact of the matter which ball hits the window first: namely Suzy’s, and so there is a fact of the matter which order the two events occur in. But there is no fact about which event really is present and which is past or future. The event of Suzy’s ball hitting the window is past relative to people who are located at the time that Billy’s ball hits the window, while the event of Billy’s ball hitting the window is future relative to people who are located at the time that Suzy’s ball hits the window.

Participants were then presented with four comprehension/attention check questions to which they were given a forced choice between true and false. Participants who failed correctly to answer these questions were excluded from the study.

1. In Universe [D] the past and present exist, but the future does not.
2. In Universe [D] the past, present, and future exist.
3. In Universe [D] there is an objective fact as to which events are present.
4. In Universe [D] events are always only past or future relative to other events.

Participants were then told the following:

“It has been discovered that our universe, the one that you and I live in, is **just like** Universe D, in fact, our universe could be Universe D.”

Participants then saw the statement “In Universe D, time passes:” and responded on a Likert scale that ran from 1 (definitely agree) to 7 (definitely disagree) (where the orientation of the Likert scale was randomised).

Experiment 1(b)

In experiment 1(b) participants saw four vignettes. The non-dynamical vignette is the same as the one used in experiment 1(a), the other three vignettes are below. Participants were then asked “which universe do you think is most like the universe we live in?” and were given a forced choice option of (a) Universe A (b) Universe B, (c) Universe C (d) Universe D.

They were then presented with the same four comprehension/attention check questions from experiment 1(a) (amended to mention the relevant universe).

They then responded to the following statement:

“In Universe [A/B/C/D] time passes” on a Likert scale that ran from 1 (definitely agree) to 7 (definitely disagree) (where the orientation of the Likert scale was randomised).

Participants who reported that they thought our universe was most like one of the dynamical vignettes (universe A, universe B, universe C), then saw the non-dynamical vignette (universe D). They were presented with the same four comprehension/attention check questions from experiment 1(a), and were then asked to respond to the following statement:

“In Universe D, time passes” on a Likert scale that ran from 1 (definitely agree) to 7 (definitely disagree) (where the orientation of the Likert scale was randomised).

Universe A: Moving Spotlight

Imagine a universe (universe A) where a single set of events—such as the extinction of the dinosaurs or the launching of a ship, or the birth of a baby—exist. All these events are equally real. The sum total of reality never grows or shrinks, so the totality of events that exist never changes. In this world past, present, and future events all exist. If there have ever existed dinosaurs, then dinosaurs exist somewhere in the universe. If there will ever exist sentient robots, then there exist sentient robots somewhere in the universe.

In addition, in this universe some of those events have a special property: the property of presentness. Only those events that have this special property are in the present. In universe A this property moves. When one

set of events has this property, the set of events that did have it, no longer do so. So events that do not have the property are either in the past (if they once had the property) or the future (if they have yet to have the property). The movement of the property is a fundamental feature of the universe and cannot be explained by anything else. So in this universe what determines whether events are truly past, present, or future, is whether they have, have already had, or will have, the property of presentness.

For example, in universe A there is the event of Suzy throwing the ball at the window, and the event of Billy throwing the ball at the window. When Suzy throws her ball, Billy is still holding his ball; he has yet to throw it. In universe A the event of Suzy throwing her ball, and the event of Billy throwing his ball, both exist. But they do not exist at the same place in space-time: the event of Suzy's ball hitting the window is earlier than the event of Billy's ball hitting the window. When the property of presentness is had by the event of Suzy's ball hitting the window that event is in the objective present, and the event of Billy's ball hitting the window is in the objective future. When the property of presentness is had by the event of Billy's ball hitting the window that event is objectively present, and the event of Suzy's ball hitting the window is objectively past.

Universe B: Presentism

Imagine a universe (universe B) in which the only events and objects that exist, are those in the present moment. So in universe B, past events and objects, and future events and objects, do not exist. Universe B is comprised of only present objects. In universe B, which objects exist, and what properties those objects have, changes. Universe B is constantly changing, so that objects that did exist go out of existence as present objects come into existence. So past objects no longer exist, and objects that will exist in the future do not yet exist.

For example, in universe B there is the event of Suzy throwing the ball at the window, and the event of Billy throwing the ball at the window. When Suzy throws her ball, Billy is still holding his ball; he has yet to throw it. When the event of Suzy's ball hitting the window comes into existence, it is in the objective present, and the event of Billy's ball hitting the window does not yet exist. It is still future. When the event of Billy's ball hitting the window comes into existence it is in the objective present, and the event of Suzy's ball hitting the window no longer exist: it is past. So in this universe first Suzy throws the ball and it hits the window, and that event then ceases to exist, then, later the event of Billy's ball hitting the window comes into existence.

Universe C: Dynamical (growing block)

Imagine a universe (universe C) where events—such as the extinction of the dinosaurs or the launching of a ship, or the birth of a baby—constantly come into existence. Events that come into existence remain in existence, so the sum total of reality grows as new events come to exist. In this universe the events that have just come into existence are those that are in the objective present. As new events come into existence already existing events become part of the past. No future events exist.

For example, in universe C there is the event of Suzy throwing the ball at the window, and the event of Billy throwing the ball at the window. When Suzy throws her ball, Billy is still holding his ball; he has yet to throw it. When the event of Suzy's ball hitting the window comes into existence, it is in the objective present, and the event of Billy's ball hitting the window does not yet exist. It is still future. When the event of Billy's ball hitting the window comes into existence it is in the objective present, and the event of Suzy's ball hitting the window exists in the objective past. So in this universe first Suzy throws the ball and it hits the window, then, later the event of Billy's ball hitting the window come into existence, at which time Suzy's throwing the ball at the window still exists, but is in the past.

3.1.3. Results

Before reporting statistics, we will summarise our main findings. We hypothesised that (H₁) people will judge that time passes in the non-dynamical world that is stipulated to be just like our world. This hypothesis was vindicated. Overall, participants judged that time passes in the block universe stipulated to be actual. In experiment 1(b) we had two hypotheses. First, that (H₂) people will judge that time passes in a counterfactual non-dynamical world, and will make that judgement regardless of whether they judged the actual world to be dynamical or not. Second, that (H₃) non-dynamists will be more inclined to judge that time passes in the counterfactual non-dynamical world than will dynamists. H₂ was not vindicated. While participants who think that the moving spotlight is most like our world judge that time passes in a counterfactual block universe, participants who think that either presentism or the growing block is most like our world do not. H₃, however, was vindicated. Non-dynamists gave significantly higher passage judgments (i.e., judgements that time passes) than dynamists to the counterfactual block universe.

Table 1 below summarises the descriptive results for passage judgments in experiment 1(a). The %Yes column represents the proportion of participants

who agree that time passes in a non-dynamical world that is stipulated to be just like our world (5, 6, 7). The %No column represents the proportion of participants who disagree that time passes that time passes in a non-dynamical world that is stipulated to be just like our world (1, 2, 3). The %4 column represents the proportion of participants who neither agree nor disagree. A one-sample t-test was run to test whether the mean passage judgment significantly differed from 4 (indifference). The result of that test below (two right-hand columns) shows that, overall, participants judged that time passes in the non-dynamical world that is stipulated to be just like our world.

Actual World	%Yes	%No	%4	Mean	SD	t-value	p-value
Block Universe (n = 75)	82.7	5.3	12	5.59	1.26	10.873	<.001

Table 1: Descriptive results for passage judgments in experiment 1(a).

Table 2 below summarises the descriptive results for passage judgments to the world that participants judged to be most like our own. For instance, the first row of the table represents the passage judgments of participants who judged that the moving spotlight world is most like our world, the second row of the table represents the passage judgments of participants who judged that the presentist world is most like our world, and so on. The %Yes column represents the proportion of participants who agree that time passes in the world that they judge to be most like our world (5, 6, 7). The %No column represents the proportion of participants who disagree that time passes in the world that they judge to be most like our world (1, 2, 3). The %4 column represents the proportion of participants who neither agree nor disagree. Separate one-sample t-tests were run for each group to test whether the mean passage judgment significantly differed from 4 (indifference). The results of those tests below (two right-hand columns) show that, overall, participants judged that time passes in the world that they judged to be most like our world.

Actual World	%Yes	%No	%4	Mean	SD	t-value	p-value
Moving Spotlight (n = 80)	85.0	7.5	7.5	5.86	1.44	11.580	<.001
Presentism (n = 71)	81.6	9.9	8.5	5.48	1.62	7.692	<.001
Growing Block (n = 55)	85.4	7.3	7.3	6.02	1.47	10.169	<.001
Block Universe (n = 117)	80.4	8.5	11.1	5.59	1.39	12.366	<.001

Table 2: Descriptive results for passage judgments to world taken to be actual in experiment 1(b).

Table 3 below summarises the descriptive results for passage judgments regarding the counterfactual non-dynamical world. For instance, the first row of the table represents passage judgments regarding the block universe, of participants who judged that the moving spotlight world is most like our world, the second row of the table represents the passage judgments regarding the block universe, of participants who judged that presentism is most like our world, and so on. The %Yes column represents the proportion of participants who agree that time passes in the counterfactual block universe (5, 6, 7). The %No column represents the proportion of participants who disagree that time passes in the counterfactual block universe (1, 2, 3). The %4 column represents the proportion of participants who neither agree nor disagree. Separate one-sample t-tests were run for each group to test whether the mean passage judgment significantly differed from 4 (indifference). Results of those tests below (two right-hand columns) are mixed. Participants who judge that the moving spotlight is most like our world, overall, judge that time passes in a counterfactual block universe. Participants who judge that presentism or the growing block is most like our world do not.

Actual World	%Yes	%No	%4	Mean	SD	<i>t-value</i>	<i>p-value</i>
Moving Spotlight	57.4	23.8	18.8	4.75	1.82	3.691	<.001
Presentism	42.2	32.4	25.4	4.13	1.79	0.597	.552
Growing Block	43.6	30.9	25.5	4.11	1.84	0.439	.662

Table 3: Descriptive results for passage judgments to counterfactual non-dynamical world in experiment 1(b).

To test whether non-dynamists (participants who judged that the block universe is most like our own) were more inclined to judge that time passes in the counterfactual non-dynamical world than dynamists (participants who judged that either the moving spotlight, presentism, or growing block is most like our own) we ran a one-way ANOVA on passage judgments made regarding the block universe. This test revealed that there was a significant effect of what universe people judge to be like our own on their passage judgments regarding the block universe, $F(3, 319) = 15.677, p < .001$. Simple effects tests with Bonferroni correction revealed that non-dynamists gave significantly higher passage judgments regarding the block universe than dynamists (Moving Spotlight: $p = .004$; Presentism: $p < .001$; Growing Block: $p < .001$). There was no significant difference in passage judgements regarding the block universe between participants who judged that either the moving spotlight, presentism, or growing block to be most like our own ($p > .138$).

3.2. Experiment 2 Methodology

3.2.1. Participants

460 people participated in the study. Participants were U.S. residents, recruited and tested online using Amazon Mechanical Turk, and compensated \$0.50 for a maximum 10 minutes of their time. Again, 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 and included both task instructions and attentional checks that doubled as comprehension checks. We excluded participants who failed either to follow task instructions or correctly answer attentional and comprehension check questions. 343 participants had to be excluded for failing to follow task instructions or vignette comprehension. This means that they failed to answer the questions or failed one of the attentional check questions (138) or failed to correctly answer 3 out of 4 comprehension questions (205). The remaining sample was composed of 117 participants (58 female; aged 21–62, mean age 37.03 (SD = 9.93)). Ethics approval for these studies was obtained from the University of Sydney Human Research Ethics Committee. Informed consent was obtained from all participants prior to testing. The survey was conducted online using Qualtrics.

3.2.2. Materials and Procedure

In this experiment participants were divided into two conditions: non-dynamical and dynamical. Participants saw one of two vignettes. They either saw the non-dynamical vignette from experiment 1a/b, or the dynamical moving spotlight vignette from experiment 1b. The moving spotlight vignette was used for this experiment as, out of the three dynamical universes, more participants thought that the moving spotlight universe was most like our world. After having seen the vignettes, participants were presented with the same four comprehension/attention check questions, and participants who failed to answer correctly were eliminated from further analysis.

Participants in both conditions then read the following description:

Time flows or flies or marches, years roll, hours pass. Our perceiving minds are stationary while time flows by like a river, with the flotsam of events upon it. The time sequence is like a moving-picture film, unwinding from the dark reel of the future, projected briefly on the screen of the present, and rewind into the dark can of the past. We are aware of

the passage of time when we reflect on our memories of what has happened. We see time passing in front of us, in the movement of a second hand around a clock, by the sights and sounds that come upon us, by the falling of sand through an hourglass, or indeed any motion or change at all. Tomorrow is an open sea of possibility. I shape tomorrow; yesterday shapes me. While today is pregnant with possibility, when tomorrow arrives I know that today will be like yesterday: set in the stone of my memories. Always we move forward, converting the future, open with possibility, into the past, closed to all but memory.

They then responded to the following statement:

“If you are told that this description is a description of Universe [C/D], how likely do you think it is that what you are told is true?” and responded on a Likert scale from (1) completely likely to (7) completely unlikely.

3.2.3. *Results*

First we will summarise our main findings. We hypothesised that (H4) people will judge that what they were told is true in both the dynamical and non-dynamical condition. This hypothesis was vindicated. Overall, participants judged that the description they were told is true in both the case of the moving spotlight and the block universe. We also hypothesised that (H5) people will be more inclined to judge that what they are told is true when they are told that the description is a description of a dynamical world, than when they are told that it is of a non-dynamical world. This hypothesis was not vindicated. We found no evidence of any difference between participants likelihood judgments between these two cases.

Table 4 below summarises the descriptive results for participants likelihood judgments in both the dynamical and non-dynamical world condition. The %Yes column represents the proportion of participants who agree that the description is likely true (5, 6, 7). The %No column represents the proportion of participants who disagree that the description is likely not true (1, 2, 3). The %4 column represents the proportion of participants who neither agree nor disagree. Separate one-sample t-tests were run for each condition to test whether the mean likelihood judgment significantly differed from 4 (indifference). The results of those two tests below (two right-hand columns) show that, overall, participants judged that the description is likely true of both the moving spotlight and the block universe.

Condition	%Yes	%No	%4	Mean	SD	t-value	p-value
Moving Spotlight (n = 54)	83.3	3.7	13.0	5.19	0.48	10.266	<.001
Block Universe (n = 63)	81.0	6.3	12.7	5.29	1.24	8.250	<.001

Table 4: Descriptive results for likelihood judgments of the description to both a dynamical and non-dynamical world.

To test whether participants were more inclined to judge that what they are told is true when they are told that the description is a description of a dynamical world, than when they are told that it is of a non-dynamical world, we compared the mean likelihood judgments between conditions using a between subjects t-test. This test found no evidence of a difference in likelihood judgments between the moving spotlight condition and block universe condition, $t(109.979) = -0.518$, $p = .605$.

3.3. Experiment 3 Methodology

3.3.1. Participants

679 people participated in the study. Participants were U.S. residents, recruited and tested online using Amazon Mechanical Turk, and compensated \$0.50 for a maximum 10 minutes of their time. 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 and included both task instructions and attentional checks that doubled as comprehension checks. We excluded participants who failed either to follow task instructions or correctly answer attentional and comprehension check questions. 556 participants had to be excluded for failing to follow task instructions or vignette comprehension. This means that they failed to answer the questions or failed one of the attentional check questions (295) or failed to correctly answer 3 out of 4 comprehension questions (261). The remaining sample was composed of 123 participants (64 female; aged 21–66, mean age 38.86 (SD = 10.73)). Ethics approval for these studies was obtained from the University of Sydney Human Research Ethics Committee. Informed consent was obtained from all participants prior to testing. The survey was conducted online using Qualtrics.

3.3.2. Materials and Procedure

In this experiment participants were divided into two conditions: mind-independent and mind-dependent. Participants saw one of two vignettes.

Universe D: Mind Independent

Imagine a universe (universe D) where a single set of events—such as a star being formed, or a particle moving, or a planet exploding—exist. All these events are equally real. The sum total of reality never grows or shrinks, so the totality of events that exist never changes. In this world past, present, and future events all exist. If there have ever existed stars, then stars exist somewhere in the universe. In universe D other times are much like other places.

For example, in universe D there is the event of a star being formed, and an event of the star exploding. When the event of the star being formed occurs, the event of that star exploding exists, and is later than the event of it being formed. When the event of that star exploding occurs, the event of the star being formed exists, and is earlier than the event of the star exploding. So both events exist, but not at the same place in space-time. But there is no fact about which event really is present and which is past or future. The event of the star exploding is future relative to the time at which it is formed, and the event of it being formed is past relative to the time at which it explodes.

In universe D earlier events tend to cause later events, so the way the universe is, at later times, is the product of the way it was at earlier times. In universe D there are (some) records of what happened in the past. So for instance, when a star explodes it leaves debris, and this serves as a record of its having exploded, just as the dent in your car door is a record of you having hit a fence. But in universe D there are no records of what will happen in the future. So if universe E contained conscious creatures, those creatures would be able to come to know about the past, by looking at the various records, in a way that they could not come to know about the future. In fact though, there are no conscious creatures in universe D; there are just particles, planets, galaxies, and the like.

Universe E: Mind Dependent

Imagine a universe (universe E) where a single set of events—such as a star being formed, or a particle moving, or a planet exploding—exist. All these events are equally real. The sum total of reality never grows or shrinks, so the totality of events that exist never changes. In this world past, present, and future events all exist. If there have ever existed stars, then stars exist somewhere in the universe. In universe D other times are much like other places.

For example, in universe E there is the event of a star being formed, and an event of the star exploding. When the event of the star being

formed occurs, the event of that star exploding exists, and is later than the event of it being formed. When the event of that star exploding occurs, the event of the star being formed exists, and is earlier than the event of the star exploding. So both events exist, but not at the same place in space-time. But there is no fact about which event really is present and which is past or future. The event of the star exploding is future relative to the time at which it is formed, and the event of it being formed is past relative to the time at which it explodes.

In universe E earlier events tend to cause later events, so the way the universe is, at later times, is the product of the way it was at earlier times. In universe E there are (some) records of what happened in the past. So for instance, when a star explodes it leaves debris, and this serves as a record of its having exploded, just as the dent in your car door is a record of you having hit a fence. But in universe E there are no records of what will happen in the future.

In universe E there are conscious creatures like you and I who have experiences. These creatures remember past events, but they do not remember future events. Their memories are one kind of record of past events. These creatures often come to know what happened in the past by consulting their memories (and other records). Because there are no records of future events, they often come to learn what will happen in the future by making a decision about what they will do. These creatures deliberate and plan, and then they form intentions to do things.

So for instance, while Suzy knows that she drank coffee yesterday because she remembers drinking coffee, she knows she will drink coffee today because she is intending to drink coffee.

Participants were presented with four comprehension/attention check questions to which they were given a forced choice between true and false.

1. In Universe [D/E] the past and present exist, but the future does not.
2. In Universe [D/E] future events are caused by past events.
3. In Universe [D/E] conscious creatures have memories of future events, but no memories of past events.
4. In Universe [D/E] conscious creatures learn about the past by remembering what happened, but they learn about the future by deciding what will happen.

Participants who failed correctly to answer these questions were excluded from the study.

‘In Universe [D/E] time passes’ and responded on a Likert scale that ran from 1 (definitely agree) to 7 (definitely disagree) (where the orientation of the Likert scale was randomised).

3.3.4. Results

We will begin by summarising our main findings. We hypothesised that (H6) people will judge that there is temporal passage in both the mind-dependent and mind-independent condition. This hypothesis was vindicated. Overall, participants judged that time passes in both conditions. Finally, we hypothesised that (H7) people will be more inclined to judge that there is temporal passage in the mind-dependent condition compared to the mind-independent condition. This hypothesis too was vindicated. Participants in the mind-dependent condition gave significantly higher passage judgments than participants in the mind-independent condition.

Table 5 below summarises the descriptive results for passage judgments in both the mind-independent and mind-dependent conditions. The %Yes column represents the proportion of participants who agree that time passes (5, 6, 7). The %No column represents the proportion of participants who disagree that time passes (1, 2, 3). The %4 column represents the proportion of participants who neither agree nor disagree. Separate one-sample t-tests were run to test whether the mean passage judgment significantly differed from 4 (indifference). The results of those two tests below (two right-hand columns) show that, overall, participants judged that time passes in both the mind-independent and mind dependent condition.

Condition	%Yes	%No	%4	Mean	SD	t-value	p-value
Mind-Independent (n = 49)	79.6	8.2	12.2	5.10	1.28	6.033	<.001
Mind-Dependent (n = 74)	87.8	4.1	8.1	5.57	1.14	11.873	<.001

Table 5: Descriptive results for passage judgments in the mind-independent and mind-dependent condition.

To test whether participants were more inclined to judge that there is temporal passage in the mind-dependent condition relative to the mind-independent condition, we compared the mean passage judgments between conditions using a between subjects t-test. The result of this test showed that participants in the

mind-dependent condition gave significantly higher passage judgments than participants in the mind-independent condition, $t(121) = -2.116$, $p = .036$.

4. Discussion

There are two central questions that we aimed to address in this paper. First, is the folk concept of temporal passage satisfied in our world if our world is non-dynamical (i.e., a block universe)? Second, insofar as the folk concept of temporal passage is satisfied if it is a block universe, is that concept satisfied by something that is mind-independent, or mind-dependent? Let's take each question in turn.

Overall, our results suggest that (in the population we sampled) people's folk concept of temporal passage is satisfied if our world is a block universe. First, people judged that time passes in our world if it's a block universe (H1 is vindicated). Second, when presented with the description, most people judged that if someone tells them that description is of a non-dynamical world, that they are being told the truth (H4 was vindicated). These two findings support the idea that the folk concept of temporal passage is satisfied if *actually* our world is non-dynamical. Indeed, there was no significant difference between the number of people who thought that this description is true of a non-dynamical world and those who thought it was true of a dynamical (moving spotlight) world (H5 was not vindicated).

This latter finding is especially interesting. One might have thought that even if people judge that the description is one that can be true in a non-dynamical world, that they would be more inclined to think that it is true in a dynamical world as compared to a non-dynamical world. In fact, though, we found no significant difference between people's judgements in these cases.

That might be taken to suggest that people's folk concept of temporal passage is one that is not only satisfied in the actual non-dynamical world, but, in addition, that dynamical worlds do not even 'better satisfy' that concept than do non-dynamical worlds. Interestingly, even non-dynamists who hold that we can find passage in our non-dynamical world have not attempted to argue that our concept of passage is not in some way *better* satisfied by dynamical worlds.³⁵ H5 suggests that even the comparative betterness of dynamical over non-dynamical worlds for satisfying our concept of passage is not supported.

In fact, though, while H5 does seem to point to this being so, we think that the results regarding H2 and H3 tend to undermine this idea. Recall that we hypothesised people would judge that time passes in a counterfactual non-

35. Though to be clear, we are not suggesting that defenders of B-passage think that dynamical worlds do better satisfy our concept of temporal passage; only that their view is consistent with that being the case.

dynamical world, and will make that judgement regardless of whether they judged the actual world to be dynamical or not (H₂) but that non-dynamists will be more inclined to judge that time passes in the counterfactual non-dynamical world than are dynamists (H₃).

Given the results regarding H₁, it should be no surprise that people who judged that the actual world is non-dynamical went on to judge that time passes in the counterfactual non-dynamical world. But amongst those who judged that our world was dynamical it was not the case that most judged that time passes in the counterfactual non-dynamical world (except, perhaps, in the case of those who judge that our world is a moving spotlight world). Rather, people were divided between those who judged that time passes in the counterfactual world and those who judged that it does not. Thus H₃ was vindicated and H₂ was not.

These results are consistent with it being the case that amongst those who think our world is dynamical, a dynamical world *does* better satisfy their concept of temporal passage.³⁶ It's important to be a bit careful here. Even if it's true that dynamists have a concept of temporal passage that is better satisfied at a dynamical world than a non-dynamical one (as H₃ suggests might be the case) this is a much weaker claim than dynamists (and some non-dynamists) typically make. For it is consistent with this being so that even dynamists have a concept of temporal passage that is satisfied if our world is non-dynamical. And indeed, the results of H₁ and H₅ strongly suggest that this is so.

Should we, though, conclude that (many) dynamists have such a concept? Well, our results are consistent with some dynamists having a sort of *conditional concept*³⁷ of temporal passage. (Recall from earlier in the paper that previous research suggests that people do not have a conditional concept of *time*, but this of course leaves open that they may have a conditional concept of *temporal passage*).

In fact, our concept of temporal passage could be conditional in several ways (that is, it could be conditional on several different features of the actual world). Its satisfaction at counterfactual worlds could be conditional on the dynamical/non-dynamical nature of the actual world. Equally, its satisfaction at counterfactual worlds could be conditional on the actual world containing, or failing

36. This is consistent with what Latham, Miller and, Norton (2020a) found in their experiment 1 with regard to the folk concept of time itself. They found that dynamists were split 50/50 between those who thought there was time in a counterfactual non-dynamical world, and those who thought there was not. (Their experiment 2 found that a majority of dynamists judged that there was time in a counterfactual non-dynamical world.) If there is a tight connection between dynamist's concept of time, and concept of temporal passage, then this result is just what we would expect.

37. See Lewis (1995) and Braddon-Mitchell (2003) for discussion and application of conditional concepts.

to contain, minds.³⁸ Or both. Let us say that the (or a) folk concept of temporal passage is *dynamically conditional* if it is a concept that is satisfied in a counterfactual non-dynamical world, conditional on our world being non-dynamical, and is not satisfied in such a world conditional on our world being dynamical. Let us say that the (or a) folk concept of temporal passage is *mind-dependently conditional* if it is a concept that is satisfied in a counterfactual mindless world, conditional on our world being mindless, and is not satisfied in such a world conditional on our world containing minds.

H2 was not vindicated. Overall, dynamists did *not* judge that time passes in a counterfactual non-dynamical world. However, nor did they, overall, judge that time does *not* pass in a counterfactual non-dynamical world either. Instead, dynamists appear to be divided between those that report that time passes in a counterfactual non-dynamical world and those who do not. Notably though, although the initial data makes it appear as though there is some difference between different dynamists (presentists, growing block theorists or moving spotlight theorists), in fact further testing found no significant differences here.

Nevertheless, this suggests that it may be that some dynamists do have a conditional concept of temporal passage. In turn, this suggests that there may be several concepts of temporal passage present in the population we tested. So, it may be that *some* people judge that our world contains temporal passage if it is non-dynamical, because they have an unconditional concept of temporal passage according to which non-dynamical worlds contain temporal passage regardless of the temporal nature of the world. And it may be the case that *other* people judge that our world contains temporal passage if it is non-dynamical because they have a conditional concept. This conditional concept may be one according to which, if actually our world is non-dynamical, then it contains temporal passage and so do counterfactual non-dynamical worlds, but if our world is dynamical, then it contains temporal passage, but counterfactual non-dynamical worlds do not.

Our results are consistent with around 50% of dynamists having a dynamically conditional concept and the other 50% of dynamists having a concept of temporal passage that is straightforwardly satisfied at any non-dynamical world regardless of the nature of our world. And if (some) dynamists have a dynamically conditional concept, then it's fair to say that they, at least, have a concept that is better satisfied in a dynamical compared to a non-dynamical world.

Even if this is so, however, it is very clear that conditional on our world in fact being discovered to be non-dynamical, overall, most people have a concept of temporal passage that is satisfied in our world. We *can* locate temporal passage in a non-dynamical world. The folk concept of temporal passage is not

38. Or indeed, it could be conditional on other factors, but we have no evidence regarding this.

a concept that is only satisfied if the actual world is dynamical. This is important news.

On the one hand, it's good news for those such as Leininger, Deng and Savitt, who argue that non-dynamical worlds contain something that deserves the name 'temporal passage'. Although they have not typically framed their claims in terms of a folk concept of passage, their claims are surely all the more plausible if our folk concept of passage is satisfied in the actual non-dynamical world.

This is also good news for other non-dynamists. Even if there is good reason to allow dynamists to use 'temporal passage' as a technical term to pick out A-theoretic change in which events are objectively present, it is nevertheless noteworthy that A-theoretic passage is not the only thing that satisfies the folk concept of temporal passage. Insofar as non-dynamists have sometimes conceded that versions of the dynamical theory better accord with our folk view of the world (in some regard or other) it may well be that they have conceded too much in this regard.

That brings us to our second question. Insofar as the folk concept of temporal passage is satisfied in the actual non-dynamical world, is what satisfies our concept mind-dependent or mind-independent? Our results suggest that it is something mind-independent. People judge that there is temporal passage present in the non-dynamical world even when it does not contain any minds (H6). This makes it very unlikely that people think that the folk concept of temporal passage is a concept of something that is satisfied in a world only if there are mental states in that world that are appropriately connected to some kind of metaphysical structure.

Indeed, and rather interestingly, our results seem to even rule out a weaker view on which the folk concept of temporal passage is mind-dependently conditional. If this were so, it would be a concept that is satisfied in a counterfactual mindless world, conditional on our world being mindless, and is not satisfied in such a world conditional on our world containing minds. To put it another way, on this view temporal passage is mind-dependent just in case actually, there are minds (perhaps connected to metaphysical structure in a certain way), and is mind-independent otherwise.

In fact though, our results undermine this idea. There surely are actual minds and, we assume, people take them to be connected to some kind of structure (dynamical or non-dynamical). So, if people had a concept like this they should judge that there is no temporal passage in counterfactual worlds that lack minds. They do not make this judgement. Thus we can rule out that people have a mind-dependently conditional concept. Instead, it seems right to say that they simply have a concept whose satisfaction in counterfactual worlds is not conditional on whether there are actually minds or not.

It is, however, worth remembering that people's judgements were stronger in the mind-dependent condition compared to the mind-independent condition.

H7 was vindicated. This suggests that people are more certain that time passes in worlds containing minds as compared to worlds containing no minds. While this does not suggest that people have a concept of temporal passage that is a mind-dependently conditional, it may suggest that they take the presence of mental states of a certain sort to be evidence of the presence of temporal passage.

5. Conclusion

Our results indicate that the folk concept of temporal passage is one that is satisfied in an actual non-dynamical, block universe world and that it is satisfied in (counterfactual) non-dynamical worlds that lack minds. This suggests, first, that we can ‘locate’ temporal passage in our world if it is non-dynamical and, second, that we should probably be attempting to locate it in something mind-independent rather than something mind-dependent. These results suggest that dynamists may need to abandon arguments for dynamism that proceed via the claim that dynamism is the only view that can accommodate the folk concept of temporal passage. In turn, our results suggest that, rather than needing to explain why non-dynamism is attractive *despite* failing to satisfy our concept of passage, the non-dynamist can instead argue that non-dynamism can straightforwardly satisfy that concept.

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