

Experimental Philosophy on Time*

James Norton

University of Iceland; jamesnorton@hi.is

Abstract

Appeals to the ‘common sense’, or ‘naïve’, or ‘folk’ concept of time, and the purported phenomenology as of time passing, play a substantial role in philosophical theorising about time. When making these appeals, philosophers have been content to draw upon their own assumptions about how non-philosophers think about time. This paper reviews a series of recent experiments bringing these assumptions into question. The results suggest that the way non-philosophers think about time is far less metaphysically demanding than philosophers have assumed.

1 Background

There is an apparent tension between what our current physical theories suggest about the nature of time, and what both common sense and subjective experience respectively tell us about the nature of time. For instance, both common sense and subjective experience are often thought to tell us that time is *dynamical*: that there is an objectively present moment, and which moment is objectively present, changes. But physics says nothing of a privileged present. Common sense tells us that time is *directed*: there is an ‘arrow of time’ that points from the past to the future. However, identifying a physical basis for the arrow of time—in asymmetric laws of nature, or causation, or thermodynamics, or quantum mechanics—has not proved a simple task.¹ Finally, while common sense tells us that events are *ordered* in time, some recent theories of quantum gravity deny even this.

Philosophers defending various *models of time* have sought to reconcile this tension in different ways. Perhaps our common-sense intuitions and experiences provide evidence of some aspects of time not captured by our current physical theories. On the other hand, perhaps these common-sense intuitions are misguided, and these experiences are illusory. Either way, appeals to the ‘common sense’, or ‘naïve’, or ‘folk’ concept of time, and the subjective experience of time, play a substantial role in philosophical theorising about time, either as revealing how the world is, or how the world must be in order for there to be time, or as something needing to be explained away.² Until very recently, philosophers have been content to draw upon their own assumptions about the folk concept of time, and their own subjective experiences of time. However, over the last couple of years, there has been a push towards empirically investigating the extent to which philosophers have accurately characterised the folk concept of time, and how non-philosophers describe the subjective experience of time.

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¹ See Farr (2020).

² Appeals to how people commonly think about time are found in McTaggart (1908), Gödel (1949), Maudlin (2002), Markosian (2004), Zimmerman (2008), Baron & Miller (2015a, 2015b), Callender (2017), Tallant (2018), and Braddon-Mitchell & Miller (2019).

This paper provides an overview of these recent findings. Firstly, a series of studies investigating the folk concept of time has suggested that most people have a less metaphysically demanding concept than philosophers have supposed. Indeed, there is evidence that roughly half the population have a concept of time *far* less metaphysically demanding than philosophers have supposed. Secondly, studies investigating how people report the subjective experience of time have found that, contrary to philosophical orthodoxy, people only weakly agree that it seems as though time passes.

2 Prior work in psychology and linguistics

This new work in experimental philosophy builds on a wealth of research at the intersection of psychology and linguistics exploring the ways in which people represent time in written and spoken language, as well as in gestures and behaviour. Much of this research concerns how people *spatialise* time. While this prior research does not directly address the veracity of philosophers' assumptions about the folk concept of time and how people describe the subjective experience of time, briefly surveying this literature will help set the scene for a more in-depth exploration of the methods and results of the new studies investigating these assumptions.

One strand of this research emphasises cross-cultural and cross-linguistic differences in how people associate the past-to-future direction of time with a spatial direction (i.e., left-to-right, right-to-left, up-to-down, etc.). For instance, there is evidence that these differences correlate with the direction in which people read and write. Fuhrman & Boroditsky (2010) found that while English-speakers tended to arrange pictures depicting a temporal sequence from left to right, Hebrew-speakers tended to arrange the same sequence from right to left, in accordance with the direction in which they read and write. There is also evidence that the language people use to talk about space impacts how they prefer to orient temporal sequences. Boroditsky & Gaby (2010), for example, found that in Pormpuraaw (a remote Australian Aboriginal community)—where relative spatial terms (like 'left' and 'right') are far less common than terms referring to cardinal directions (like 'north' and 'south')—people tended to arrange pictures depicting a temporal sequence according to cardinal directions, namely, from east to west, no matter which direction they were facing while completing the task. Similarly, the language people use to talk about space appears to impact the language they use to talk about time. Núñez, Cooperrider, Doan, & Wassmann (2012) investigated the spatial and temporal language used by the Yupno, who live in a mountainous region of Papua New Guinea, and found that the frequent use of 'uphill' and 'downhill' to describe spatial locations was accompanied by use of these same expressions to describe temporal locations: uphill events are in the future and downhill events are in the past.

Another strand of this research has used a more fine-grained methodology in order to probe people's association between the past-to-future direction of time and a spatial direction. These studies measure people's reaction times when judging the truth of various temporal phrases (like 'May comes earlier than June'), after being primed to think of a certain spatial direction as 'forward'. For instance, Boroditsky (2001) found evidence that Mandarin-speakers had faster reaction times after being exposed to vertical primes than they did after being exposed to horizontal primes, and *vice versa* for English-speakers. Boroditsky inferred from this that while Mandarin-speakers tend to think of time more vertically, English-speakers tend to think of time more horizontally. She hypothesised that this is because English includes a lot of horizontal spatial metaphors—like 'the worst is behind us'—while Mandarin tends to include vertical

metaphors—like referring to the temporally prior month with ‘the month above’.³ While Chen (2007) failed to replicate Boroditsky’s (2001) findings, corroborative evidence has been collected by Boroditsky, Fuhrman, & McCormick (2011) and Fuhrman, McCormick, Chen, Jiang, Shu, Mao & Boroditsky (2011). With that said, Casasanto & Bottini (2014) found that these preferences are very flexible, and can be manipulated within minutes by presenting people with differently oriented stimuli and instructions.

While this research emphasises variability in which spatial direction people associate with the past-to-future direction of time, it is important to remember that this variation is accompanied by an apparent universality in our more general tendency to draw upon spatial concepts in order to represent time and to communicate with one another about the temporal ordering of events (Núñez & Cooperrider, 2013). Another apparently universal feature of our temporal language is the use of both tensed/‘deictic’ expressions (describing events as past, present or future) and tenseless/‘sequence’ expressions (describing events as earlier than, later than, or simultaneous with other events), which appears to be ubiquitous across different languages and cultures (Sinha & Gärdenfors, 2014).⁴

Yet another strand of this research investigates the metaphors people use to characterise the passing of time. These have been divided into *moving time* metaphors, where future events are represented as moving towards an observer who remains fixed, and *moving ego* metaphors, where future events remain fixed while the observer moves towards them (Clark, 1973; Lakoff, 1993; Lakoff & Johnson, 1999).⁵ A series of studies has explored how various kinds of priming (including undergoing, or even just imagining, motion) can dispose people to interpret ambiguous English phrases as moving time expressions or as moving ego expressions.⁶

Overall, this research program has illuminated many aspects of how people represent time. However, it leaves unanswered the questions about the folk concept of time, and about how people describe the subjective experience of time, that are at issue in contemporary philosophical debates. The new series of studies were explicitly designed to answer these questions.

3 Models of time

To understand the methodology, results and upshots of this new research requires an overview of some competing models of time. The first three are *dynamical* (A-theoretic) models, according to which *time passes*: there is an objectively present moment, and which moment is objectively present, changes.⁷ These models nonetheless disagree about the ontological status of non-present events (i.e. past and future events), and in what the passage of time consists.

Presentism is the view that only the present moment exists. Past and future events do not exist, but they respectively *did* and *will* exist, because the passage of time consists in changes in what

³ The Aymara people of the Andes also use horizontal spatial metaphors, but in the opposite orientation to English: in both language and gesture, the past is represented to be in front of them, and the future behind them (Núñez & Sweetser, 2006).

⁴ Early work by Whorf (1950:67) suggesting that the Hopi language “is seen to contain no words, grammatical forms, constructions or expressions that refer directly to what we call TIME, or to past, present, or future, or to enduring or lasting” was thoroughly debunked by Malokti (1983).

⁵ See Moore (2006, 2011), Núñez (1999) and Núñez, Motz & Teuscher (2006) for alternative ways to categorise these expressions.

⁶ See Boroditsky (2000), Boroditsky & Ramscar (2002), Gentner, Imai, & Boroditsky (2002) and McGlone & Harding (1998).

⁷ In what follows, talk of time passing always picks out this dynamical understanding of passage.

exists. The world is a massive three-dimensional object (an ‘instant’) which changes as time passes.⁸

The **moving spotlight** is the view that the past, present and future all exist, and the passage of time consists in the change of which events are (objectively) present. There is a ‘spotlight of presentness’ inexorably making its way from the earlier to the later regions of spacetime, and the events it ‘illuminates’ are present. Events that are not yet present are future; events that are no longer present are past. The future direction of time is the direction in which the spotlight moves.⁹

The **growing block** is the view that the past and present exist, but the future does not. The passage of time consists in new three-dimensional objects (‘instants’) coming into existence at the ‘growing’ end of the block. The present is the newest instant to come into existence. The future direction of time is the direction in which the block is growing.¹⁰

The next four models are *non-dynamical* models according to which there is no temporal passage.

The **B-theory** is the view that the past, present and future all exist, yet there is no objective present. There is nothing analogous to the ‘spotlight of presentness’, and this is the sense in which time is non-dynamical. Instead, ‘present’ is an indexical term which simply refers to the point in time at which it is uttered, much like ‘here’ simply refers to the point in space at which it is uttered. However, time is nonetheless *directed*, in the sense that one temporal direction is, objectively, future, and (from a given frame of reference) it is an objective matter which events are earlier or later than which.¹¹

The **C-theory** is the view that the past, present and future exist, and there is no objective present, and furthermore *time is not directed*. Neither temporal direction is objectively the future, and no events are objectively earlier or later than others. Instead, local asymmetries in time—such as the increase of entropy in one direction—lead us to treat the two temporal directions differently. However, events are *ordered*, in the sense that there are facts about which events occur *between* which other events. So, on this model it is not strictly speaking true that you are reading this *after* I wrote it, but it is true that your choosing to read it is *between* my writing of it and your reading of it.¹²

The **unordered** model dispenses with dynamism, direction *and ordering*. This model is motivated by some recent accounts of quantum gravity that attempt to reconcile relativistic physics with quantum mechanics, and is sometimes called ‘timeless’ because it represents the world as a collection of three-dimensional objects (‘instants’), none of which are connected by any spatiotemporal relations.¹³ So, no events are earlier or later than any others, and indeed there is no temporal dimension along which events can be arranged in such a way that one is located *between* others. In other words, there is nothing corresponding to a *timeline*. It is thus not the case that your choosing to read this article is between my writing of it and your reading of it. These events all exist, but there is no sense in which they are ordered.

⁸ See Markosian (2004), Tallant (2012) and Leininger (2015).

⁹ See Cameron (2015), Deasy (2015) and Miller (2017a).

¹⁰ See Tooley (1997), Deng (2017) and Rosenkranz & Correia (2018).

¹¹ See Le Poidevin (1991), Tegmeier (1996), Mellor (1998), Albert (2000), Maudlin (2007) and Loewer (2012).

¹² See Price (1997, 2007) and Farr (2012, 2018, 2020).

¹³ This view—found in Barbour (1994a, 1994b, 1999)—is just one theory of quantum gravity. Others have different features; see Matsubara (2017).

Finally, the **one-instant** model is the view that the world is a single unchanging three-dimensional object. One way to conceive of this model is as a presentist model without change. Thus there is no dynamism, no direction, no ordering, *and no other instants*. It is perhaps misleading to call this a model *of time*, since it is typically presented as a clear example of how things might be such that there is no time (i.e. a model on which *temporal error theory* is true).¹⁴

For ease of reference in what follows, Figure 1 shows which models represent time as dynamical, directed, and ordered.

Figure 1. Which models of time are dynamical, directed and ordered?

	Dynamism	Direction	Ordering
Presentism	✓	✓	✓
Moving Spotlight	✓	✓	✓
Growing Block	✓	✓	✓
B-theory	✗	✓	✓
C-theory	✗	✗	✓
Unordered	✗	✗	✗
One-instant	✗	✗	✗

With these models thus articulated, we can ask people the question: which model accurately describes the world in which we live? Moreover, for each of these models, we can ask: if a world is as described by this model, is there time in that world? In other words, on which of these models is the folk concept of time satisfied? More specifically, what role do dynamism, direction and order play in the folk concept? These are questions that the recent surge of experimental philosophy has sought to answer.

4 What role does dynamism play in the folk concept of time?

According to McTaggart (1908), Gödel (1949) and Williams (1998, 2003) dynamism is *essential* to time.¹⁵ The assumption seems to be that the concept of time—the ordinary folk concept, not a technical philosophical concept—is satisfied by a world only if that world is dynamical. It is this assumption, together with his argument that dynamism is contradictory, that leads McTaggart to the extreme conclusion that *there is no time*. Even those who stop short of claiming that dynamism is essential to the folk concept of time (indeed, even non-dynamists who defend non-dynamical models) have supposed that dynamism nonetheless plays an important role in the concept. Dynamists have taken this as a defeasible reason to prefer dynamical models,¹⁶ while non-dynamists contend that dynamism's intuitive appeal is outweighed by its problems, especially its lack of fit with physics.¹⁷

¹⁴ Sider (2001) and Effingham & Melia (2007) describe this model as timeless, and Baron & Miller (2015a) discuss temporal error theory.

¹⁵ Similar thoughts can be found in Buddhist philosophy; see Miller (2017b). Gale (1968), Schlesinger (1982), Smith (1993) and Ludlow (1999) argue in favour of dynamism by making the case that talk of the past, present and future can't be reduced to talk of B-theoretic temporal order plus indexicals. It's not clear whether this amounts to dynamism being essential to the concept of time.

¹⁶ This line of argument can be found in Smith (1994), Schlesinger (1994), Craig (2000), Maudlin (2002), Markosian (2004), and Zimmerman (2008).

¹⁷ Ismael (2012) and Callender (2017) seek to undermine the intuitive appeal, while Baron (2018) provides an overview of the issues with relativity and dynamism.

But what role does dynamism *really* play in the folk concept of time? Two studies have sought to shed light on this question.

In two experiments, Latham, Miller & Norton (2021) presented participants with a series of six vignettes respectively describing presentism, growing block, moving spotlight, B-theory, C-theory and unordered models of time. Participants were asked to judge which vignette described a universe *most like our universe*.¹⁸ In other words, participants were invited to indicate what they think time is like in the actual world. Consistently across the two experiments, significantly more participants (~70%) endorsed a dynamical model. However, a surprisingly large subpopulation (~30%) endorsed a non-dynamical model.

Across the two experiments there was variation in the proportions of participants endorsing *particular* dynamical models (and to a lesser degree particular non-dynamical models). This might be due to people's representation of time being indeterminate in some respects. In particular, people may have strong intuitions about whether the world is dynamical or non-dynamical, but weaker intuitions about precisely how dynamism works (for dynamists) or about direction and ordering (for non-dynamists).

Latham et al. also sought to determine the extent to which the responses of non-dynamists really reflected common-sense intuitions, by testing whether they were more likely to have engaged in more sophisticated reflection or with relevant scientific research. If that were so, it might be that these participants *previously* had a naïve dynamical concept, which was subsequently supplanted by a scientifically informed non-dynamical concept. However, no correlations were found between people's choice of a dynamical or non-dynamical model and their levels of education or engagement with scientific research on time, suggesting that almost one third of people naïvely think that time is non-dynamical.

The fact that a significant majority of people endorsed dynamism in these experiments supports the idea that dynamism captures something important to the folk concept of time. On the other hand, it is noteworthy that a substantial minority of participants are non-dynamists. Assuming that these people are not temporal error theorists (i.e., their belief in non-dynamism hasn't led them to conclude that there is no time), these responses suggest that their concept of time is not essentially dynamical: it is satisfied by non-dynamical models.

Indeed, probing what people think time is like in the actual world provides limited information about their *concept* of time, since disagreement regarding the former might accompany agreement regarding the latter. People may believe they live in a dynamical world, for example, and yet have a concept of time that is also satisfied by non-dynamical models.

To more directly investigate the role that dynamism plays in the folk concept of time, Latham, Miller & Norton (2020a) conducted two experiments eliciting people's judgements about *whether or not there is time* in dynamical and non-dynamical worlds. Participants were presented with a vignette describing a dynamical model (growing block in one experiment; presentism in the other) and a vignette describing a non-dynamical model (B-theory), and were asked which vignette they think describes a universe most like our own.¹⁹ They were then asked to judge whether there is time in the scenario described by each vignette.

¹⁸ The researchers have made the survey available online. Interested readers can take the survey, and compare their response with those of the original study participants, at https://sydneypsy.qualtrics.com/jfe/form/SV_6R2au9bDZnHv3yl.

¹⁹ The vignettes omitted temporal locutions like 'past', 'present', 'future', 'earlier/later than', etc., which are likely to predispose participants to judge that there is time. Latham et al. reran their (2021) study with these 'time-neutral'

Latham et al. found that when presented with a choice between the growing block and the B-theory, or between presentism and the B-theory, only ~45% of participants were inclined to say that the dynamical model (growing block/presentism) describes a world most like the actual world. In other words, just over half of participants were *non-dynamists*, and just less than half were *dynamists*. By contrast, recall that Latham et al. (2021) found that ~70% of people are dynamists. Taken together, these results tell against the above suggestion that people have strong intuitions about whether the world is dynamical or non-dynamical. Perhaps instead people have strong intuitions about whether the world is *directed* or *non-directed*, but weaker intuitions about which of the directed models is accurate.

In the experiment comparing the growing block to the B-theory, Latham et al. (2020a) found that a significant majority of both dynamists and non-dynamists judged that there was time in both growing block and B-theory worlds. In the experiment comparing presentism to the B-theory, the responses of dynamists and non-dynamists diverged. A significant majority of non-dynamists judged that there was time in both growing block and B-theory worlds. However, while a significant majority of dynamists judged that there was time in growing block worlds, only ~60% of dynamists judged there to be time in B-theory worlds, which did not differ significantly from a 50/50 split.²⁰

Overall these results suggest that dynamism is *not* essential to most people's concept of time. Instead, it appears that for most people, the B-theory model is sufficient for there to be time.

5 Direction and ordering

If dynamism is not, after all, essential to the folk concept of time, what *is* essential? Follow-up work has investigated how little temporal structure there must be in order to evoke the judgement that there is no time. These studies shed light on recent work on temporal error theory, which has attempted to spell out the minimal requirements to satisfy the folk concept of time, thus informing the question of which models are 'timeless'. As we will see, the results support Baron & Miller's (2015b) contention that the folk concept of time is highly resistant to elimination, in that many people are prepared to judge that there is time in worlds with very minimal temporal structure.

Latham, Miller & Norton (2020b) investigated the role that *direction* plays in the folk concept of time, using the same methodology as their (2020a) used to investigate the role of dynamism. Participants were presented with a vignette describing a directed model (growing block in one experiment; B-theory in the other) and a vignette describing a non-directed model (C-theory), and were asked which vignette they think describes a universe most like our own. They were then asked to judge whether there is time in the scenario described by each vignette.

vignettes and found a similar distribution, confirming that people can comprehend vignettes that lack these locutions.

²⁰ In one condition, participants were asked to suppose that the actual world is dynamical when making these judgements. In another they were asked to suppose that the actual world is non-dynamical. This manipulation had no effect on their judgements. This tells against the proposal that the folk concept of time has a conditional structure, such that what is essential to time depends on what time is like actually (see Majeed (ms) and Baron & Miller (2015a, 2015b)). For ease of presentation, how people were asked to suppose the actual world to be is not reported here; results from these conditions (in Latham, Miller & Norton (2020a, 2020b) and Latham & Miller (2020a)) are reported together.

Latham et al. found that when asked which vignette describes a world most like the actual world, ~71% of participants chose the growing block over C-theory and ~64% chose B-theory over C-theory. Thus a surprisingly substantial minority of participants appear to be *non-directionists* who think there is no direction of time in the actual world.

To most directly address the role that direction plays in the folk concept of time, it is helpful to focus on responses to the C-theory vignette. Interestingly, these responses differed between the two experiments. In the experiment comparing B-theory to C-theory, roughly three-quarters of participants judged that there is time in C-theory worlds. This suggests that direction is not essential to most people's concept of time. However, in the experiment comparing the growing block to C-theory, roughly half of participants judged that there is time in C-theory worlds. This suggests that direction is essential to roughly half of the participants' concept of time. In each experiment, there were significantly higher levels of agreement that there is time in the directed world over the non-directed world.

Overall, these results suggest that some people are sensitive to the presence or absence of direction. Moreover, the difference in results between the two experiments suggests that this sensitivity is exacerbated when participants have recently read a description of a dynamically directed model like the growing block, which Latham et al. (2020b) describe as a kind of priming effect. When the dynamical growing block theory is made salient, over three-quarters of participants judge that there is time in B-theory worlds (Latham et al., 2020a), but only half of participants judge that there is time in C-theory worlds (Latham et al., 2020b). Nevertheless, the latter result strongly suggests that *at least half* of the population do not deem direction to be essential to time.

Surprisingly, the subpopulation who judge that there is time even in non-directed C-theory worlds, also judge that there is time in worlds that lack not only dynamism and direction, but also *ordering*. Latham & Miller (2020a) investigated whether people judge there to be time in unordered worlds (Latham & Miller call these 'quantum gravity worlds'; recall that these are worlds in which there is no temporal ordering; no events are before or after others, or between others). In each experiment, participants were presented with a growing block vignette, a C-theory vignette and an unordered vignette. Thus, a dynamical model was made salient in both experiments. Latham & Miller found significantly higher levels of agreement that there is time in growing block worlds versus unordered worlds, and significantly higher levels of agreement that there is time in C-theory worlds versus unordered worlds. Remarkably, though, overall ~36-49% of people judged that there is time in unordered worlds.

Finally, Latham & Miller (2020b) used a slightly different methodology to investigate whether people judge there to be time in *one-instant* worlds. Latham & Miller sought to test Tallant's (2018) hypothesis that whether or not there is time in a one-instant world depends on whether there are present-tensed truths in that world. To test this, they split participants into three conditions, respectively reading vignettes describing one-instant worlds *with* or *without* present-tensed truths, or in which it is uncertain whether there are present-tensed truths.

The results were the same in all conditions: there was an even split between those participants who judged that there is time and those participants who judged that there is no time. This strongly suggests that people's responses to one-instant worlds are not sensitive to the presence or absence of present-tensed truths. More strikingly, these results suggest that roughly half of the population judge that there is time in a world with very minimal temporal structure indeed: just a three-dimensional (unchanging) object.

Taken collectively, these studies suggest that there is more than one concept of time present in the population tested. Roughly half the population deploy extremely undemanding concept(s) on which *not even ordering* is essential; on which there need not exist more than one instant. This raises the further question of what *is* required in order to for there to be time. Some of the remaining population appear to deploy a concept (or concepts) on which direction and ordering are essential.

All in all, the folk concept(s) of time present in the population are either somewhat more minimal, or far more minimal, than philosophers have supposed.

6 New work on temporal phenomenology

The studies presented in §4-5 focused on people's judgements about which model of time best describes the world in which they live, and about whether or not there is time in various scenarios, as a way of investigating their *concept* of time. Another topic of recent experimental work has instead investigated a particular aspect of the *subjective experience* of time which Latham, Miller & Norton (2020c) call *purported passage phenomenology*: the phenomenology that allegedly represents that time passes. Two pervasive assumptions have been brought into question. The first is that most people report that they unambiguously have a phenomenology as of time passing. The second is that the greater the extent to which people report having said phenomenology, the more likely they are to endorse a dynamical theory of time over a non-dynamical theory of time.

Defenders of non-dynamical and dynamical theories alike take themselves to be able to account for the presumed fact that when asked whether time *seems* to pass, people will strongly agree.²¹ Dynamists typically hold that we represent that time passes, and this representation is veridical since time in fact passes.²² Some non-dynamists concede that we represent that time passes, but insist that this phenomenology is illusory.²³ Other non-dynamists deny that we represent that time passes, and claim instead that people *misreport* that time seems to pass, perhaps because (for example) their tacit endorsement of dynamism leads them to misdescribe their phenomenology.²⁴

It is typically supposed that there is a correlation between reporting stronger purported passage phenomenology and belief in dynamism. The idea is that, if we do represent that time passes, we should expect said phenomenology to inform our picture of the world, and stronger phenomenology is more likely to lead people to endorse dynamism. Likewise, if people's tacit belief in dynamism is causing them to misreport that time seems to pass, we should expect to see the same correlation, albeit for a very different reason.

Latham et al. (2020c) presented participants with a range of statements describing passage phenomenology, such as 'It feels to me like the present moves'. They found that participants only weakly agreed with these statements, and even more weakly *disagreed* with negatively framed statements such as 'I cannot feel time passing'. Surprisingly, they found no evidence that levels

²¹ See Skow (2011) and Baron, Cusbert, Farr, Kon & Miller (2015). For descriptions of the alleged phenomenology in question, see Schuster (1986:695), Davies (1995:275), and Le Poidevin (2007:76).

²² Indeed, it is common for dynamists to argue that the content of our phenomenology gives us reason to be dynamists. See Smith (1994), Schlesinger (1994), Craig (2000) and Skow (2011).

²³ See Prosser (2007, 2012, 2013), Le Poidevin (2007), Callender (2008), Paul (2010), Dainton (2011), Ismael (2012) and Hohwy, Paton & Palmer (2016).

²⁴ See Braddon-Mitchell (2013), Deng (2013a; 2013b; 2018; 2019), Bardon (2013:95), Hoerl (2014), Baron et al. (2015), Torrenco (2017), Miller, Holcombe & Latham (2018), Balcells (2019), Miller (2019) and Farr (2020).

of agreement with these statements was correlated with endorsing dynamism or non-dynamism. They tentatively propose that people's temporal phenomenology is ambiguous and can be interpreted in different ways when participants are presented with different expressions.

Shardlow, Lee, Hoerl, McCormack, Burns & Fernandes (2020) investigated similar questions. When participants were presented with the statement 'I feel time passing', the mean response was 72, on a scale from 0 (completely disagree) to 100 (completely agree), and 83% of responses were greater than 50. This once again suggests that while most people agree with these statements, they do so less strongly than philosophers have predicted.

Motivated by the ambiguity of such statements, Shardlow et al. also asked participants what they take that expression to mean. Roughly three-quarters of participants endorsed one of the dynamical interpretations ('Things move from being in the future to being in the present to being in the past' or 'What time is 'now' changes') and one quarter endorsed one of the non-dynamical interpretations ('Different things happen at different times' or 'One thing happens at one time, another thing happens at another time'). Most people, then, are interpreting these statements in the way intended. Interestingly, there was no association between how participants interpreted the statement and their levels of agreement: people are no more inclined to agree to these statements if they interpret them in a less metaphysically demanding way.

Overall, Shardlow et al. classify 73% of participants as 'A-experiencers' (i.e., they agree, weakly or strongly, that they can feel time passing, and interpret this expression dynamically). They argue that our purported passage phenomenology is not as ambiguous as Latham et al. suggest. Instead, they propose that the ambiguity lies in how best to *describe* the phenomenology, which can perhaps only be captured in metaphorical terms (Shardlow et al., 2020:19-20).

Interestingly, while these two studies report similar results, the authors emphasise different upshots. Latham et al. emphasise that the received wisdom overstates the extent to which people report feeling like time passes. They suggest that the lack of strong agreement with statements describing temporal passage phenomenology indicates that there is no pressing requirement for those who defend non-dynamical models of time to explain why people so strongly report that time seems to pass when in fact (according to their preferred model) it does not. By contrast, Shardlow et al. emphasise that the majority of participants did agree with these statements, and suggest that their data provides defeasible support for arguments in favour of dynamism. Importantly, they also note that these studies are limited by only being able to gather data regarding how people *describe* their phenomenology; if people are prone to misdescribe their phenomenology this methodology may not provide insight into how people in fact experience time.

The state of play, then, is as follows. Dynamists contend that reports of time seeming to pass are best explained by our successfully tracking dynamical features of the world. Non-dynamists contend that such reports are best explained by our having illusory phenomenology, or misreporting our own phenomenology. While these empirical studies cannot resolve debates about which explanation is best, they can help us to get clear on what needs to be explained. The question, then, is whether weak agreement, on average, that time seems to pass, and 73% of people being A-experiencers, is best explained by our veridically experiencing time passing, or by a pervasive illusion, or by people misreporting their own phenomenology.

7 Conclusion

Empirical evidence suggests that neither the folk concept of time, nor the way people report the experience of time passing, is as metaphysically demanding as philosophers have supposed. Dynamism is not essential to the folk concept of time. For roughly half the population, neither is direction or ordering. People only weakly agree that time seems to pass. The common-sense picture of time and the picture of time in physics might not be so difficult to reconcile after all.

Of course, the existing research has its limitations, discussion of which suggests some avenues for future research.

Firstly, six of the seven studies were implemented using Amazon's Mechanical Turk, a service that allows people to participate in surveys online in return for financial compensation. The experimenters implemented attentional checks and comprehension checks, and surveyed only Mechanical Turk participants with a strong record of completing surveys to the satisfaction of survey-providers. However, results obtained from seasoned Mechanical Turk participants who chose to undertake a survey about time might not generalise to other people; replications of these studies using random samples would be valuable. For similar reasons, it is important to note that these participants were all US residents. There is evidence—albeit contentious—suggesting that people from different cultural backgrounds sometimes make different judgements when asked to deploy concepts of interest to philosophers.²⁵ This is particularly likely to be the case with the concept of time, given the cross-cultural and cross-linguistic differences discussed in §2. Care must therefore be taken not to presume the universality of these results, and further investigation of samples from different cultural and linguistic backgrounds would be valuable.

Secondly, recall (from fn.19) that the experimenters stripped their vignettes of temporal language so as not to predispose participants to judge that there is time. Given the surprising portion of people who judge that there is time in one-instant worlds, it would be valuable to explore whether there are other confounding cues. For example, it might be that each vignette purporting to describe a 'universe' inclines people to judge that there is time, because they think that all universes contain time. Future studies might explore different ways of capturing the models of time, perhaps using pictures and animations.

Finally, to be clear, the finding that most people think about time a certain way is not the finding that the world *is* that way. Ontology is not a democracy. Rather, these studies tell us about how people *believe* the world to be, how people report *experiencing* time, and about the folk *concepts* of time, concepts that may or may not be satisfied by the world.

References

- Albert, D. Z. (2000). *Time and chance*. Cambridge: Harvard University Press.
- Balcells, M. (2019). The dynamic block universe and the illusion of passage. In A. Bardon, V. Artsila, S. E. Power, & A. Vatakis (Eds.), *The illusions of time: philosophical and psychological essays on timing and time perception*. Palgrave Macmillan: Cham.
- Barbour, J. (1994a). The timelessness of quantum gravity: I. The evidence from the classical theory. *Classical Quantum Gravity*, 11(12), 2853–2873.
- Barbour, J. (1994b). The timelessness of quantum gravity: II. The appearance of dynamics in static configurations. *Classical Quantum Gravity*, 11(12), 2875–2897.
- Barbour, J. (1999). *The end of time*. Oxford: Oxford University Press.
- Bardon, A. (2013). *A brief history of the philosophy of time*. Oxford: Oxford University Press

²⁵ Knobe (2019) argues that these intuitions are in fact surprisingly robust over demographic differences.

- Baron, S. (2018). Time, physics, and philosophy: It's all relative. *Philosophy Compass*, 13(1), e12466.
- Baron, S., & Miller, K. (2015a). What is temporal error theory? *Philosophical Studies*, 172(9), 2427–2444.
- Baron, S., & Miller, K. (2015b). Our concept of time. In B. Mölder, V. Arstila, & P. Ohrstrom (Eds.), *Philosophy and psychology of time*. Berlin: Springer.
- Baron, S., Cusbert, J., Farr, M., Kon, M., & Miller, K. (2015). Temporal experience, temporal passage and the cognitive sciences. *Philosophy Compass*, 10(8), 56–571.
- Boroditsky, L. (2001). Does language shape thought? English and Mandarin speakers' conceptions of time. *Cognitive Psychology*, 43, 1–22.
- Boroditsky, L. (2000). Metaphoric Structuring: Understanding Time through Spatial Metaphors. *Cognition* 75(1):1-28.
- Boroditsky, L., & Gaby, A. (2010). Remembrances of times East: absolute spatial representations of time in an Australian aboriginal community. *Psychological science*, 21(11), 1635-1639.
- Boroditsky, L., Fuhrman, O., & McCormick, K. (2011). Do English and Mandarin speakers think about time differently? *Cognition*, 118, 123–129.
- Boroditsky, L., & Ramscar, M. (2002). The roles of body and mind in abstract thought. *Psychological Science*, 13, 185–189.
- Braddon-Mitchell, D., & Miller, K. (2019) Quantum gravity, timelessness, and the contents of thought. *Philosophical Studies* 176, 1807–1829.
- Braddon-Mitchell, D. (2013). Against the illusion theory of temporal phenomenology. *CAPE Studies in Applied Ethics*, 2, 211–233.
- Callender, C. (2008). The common now. *Philosophical Issues*, 18(1), 339–361.
- Callender, C. (2017). *What makes time special?* Oxford: Oxford University Press.
- Cameron, R. P. (2015). *The moving spotlight: An essay on time and ontology*. Oxford: Oxford University Press.
- Casasanto, D., & Bottini, R. (2014). Mirror reading can reverse the flow of time. *Journal of Experimental Psychology: General*, 143, 473–479.
- Chen, J. Y. (2007). Do Chinese and English speakers think about time differently? Failure of replicating Boroditsky (2001). *Cognition*, 104, 427–436.
- Clark, H. H. (1973). Space, time, semantics, and the child. In *Cognitive development and acquisition of language* (pp. 27-63). Academic Press.
- Craig, W. L. (2000). *The tensed theory of time: a critical examination*. Dordrecht: Kluwer Academic Publishers.
- Dainton, B. (2011). Time, passage and immediate experience. In C. Callender (Ed.), *Oxford handbook of philosophy of time*. Oxford: Oxford University Press.
- Davies, P. (1995). *About Time: Einstein's Unfinished Revolution*. New York: Simon and Schuster.
- Deasy, D. (2015). The moving spotlight theory. *Philosophical Studies*, 172(8), 2073-2089.
- Deng, N. (2013a). On explaining why time seems to pass. *Southern Journal of Philosophy*, 51, 367–382.
- Deng, N. (2013b). Our experience of passage on the B-Theory. *Erkenntnis*, 78, 713–726.
- Deng, N. (2017) Making Sense of the Growing Block View. *Philosophia* 45, 1113–1127.
- Deng, N. (2018). On 'experiencing time': A response to Simon Prosser. *Inquiry*, 61(3), 281–301.
- Deng, N. (2019). One thing after another: why the passage of time is not an illusion. In A. Bardón, V. Arstila, S. E. Power, & A. Vatakis (Eds.), *The illusions of time: philosophical and psychological essays on timing and time perception*. Palgrave Macmillan: Cham.
- Effingham, N., & Melia, J. (2007). Endurantism and timeless worlds. *Analysis*, 67(2), 140–147.
<https://doi.org/10.1093/analys/67.2.140>
- Evans, V. (2003). *The structure of time: Language, meaning and temporal cognition*. Amsterdam: John Benjamins Publishing.
- Farr, M. (2012). On A- and B-theoretic elements of branching spacetimes. *Synthese*, 188(1), 85-116.
- Farr, M. (2018). Causation and Time Reversal. *British Journal for the Philosophy of Science*. 71(1), 177–204.
- Farr, M. (2020). C-theories of time: On the adirectionality of time. *Philosophy Compass*, e12714.
- Farr, M. (2020). Explaining temporal qualia. *European Journal for Philosophy of Science*, 10(1), 1-24.
- Fuhrman, O., & Boroditsky, L. (2010). Cross-cultural differences in mental representations of time: Evidence from an implicit non-linguistic task. *Cognitive Science*, 34, 1430–1451.
- Fuhrman, O., McCormick, K., Chen, E., Jiang, H., Shu, D., Mao, S., & Boroditsky, L. (2011). How linguistic and cultural forces shape conceptions of time: English and Mandarin time in 3D. *Cognitive Science*, 35, 1305–1328.
- Gale, R. M. (1968). *The language of time*. Virginia: Humanities Press.
- Gentner, D., Imai, M., & Boroditsky, L. (2002). As time goes by: Evidence for two systems in processing space→time metaphors. *Language and cognitive processes*, 17(5), 537-565.
- Gödel, K. (1949). An Example of a New Type of Cosmological Solutions of Einstein's Field Equations of Gravitation. *Reviews of Modern Physics* 21 (3): 447–450.
- Hoerl, C. (2014). Do we (seem to) perceive passage? *Philosophical Explorations*, 17, 188–202.
- Hohwy, J. Paton, B. & Palmer, C. (2016). Distrusting the Present, *Phenomenology and the Cognitive Sciences*, 15(3):315–35.
- Ismael, J. (2012). Decision and the open future. In A. Bardón (Ed.), *The future of the philosophy of time* (pp. 149–169). Abingdon: Routledge.

- Knobe, J. (2019). Philosophical intuitions are surprisingly robust across demographic differences. *Epistemology & Philosophy of Science*, 56(2).
- Lakoff, G. (1993). The contemporary theory of metaphor. In A. Ortony (Ed.), *Metaphor and thought* (2nd ed., pp. 202–251). Cambridge, UK: Cambridge University Press.
- Lakoff, G., & Johnson, M. (1999). *Philosophy in the flesh*. New York: Basic Books.
- Latham, A. J., Miller, K., & Norton, J. (2021). Is our naïve theory of time dynamical? *Synthese*, 198, 4251–4271. DOI: 10.1007/s11229-019-02340-4
- Latham, A. J., Miller, K., and Norton, J. (2020a). Do the Folk Represent Time as Essentially Dynamical? *Inquiry*. DOI: 10.1080/0020174X.2020.1827027
- Latham, A. J., Miller, K., and Norton, J. (2020b). An empirical investigation of the role of direction in our concept of time. *Acta Analytica*. DOI: 10.1007/s12136-020-00435-z
- Latham, A. J., Miller, K., & Norton, J. (2020c). An empirical investigation of purported passage phenomenology. *The Journal of Philosophy*, 117(7), 353–386.
- Latham, A. J., & Miller, K. (2020a). Quantum gravity, timelessness, and the folk concept of time. *Synthese*, 1–26.
- Latham, A. J., & Miller, K. (2020b). Time in a one-instant world. *Ratio*, 33(3), 145–154.
- Le Poidevin, R. (2007). *The images of time: An essay on temporal representation*. Oxford: Oxford University Press.
- Le Poidevin, R. (1991). *Change, cause and contradiction; a defence of the tenseless theory of time*. London: Macmillan Press Ltd.
- Leininger, L. (2015). Presentism and the myth of passage. *Australasian Journal of Philosophy*, 93(4), 724–739.
- Loewer, B. (2012). Two accounts of laws and time. *Philosophical Studies*, 160(1), 115–137.
- Ludlow, P. (1999). *Semantics, Tense, and Time*. Cambridge, MA: MIT Press.
- Majeed, R. (ms). ‘A conditional analysis of time.’
- Malokti, E. (1983) *Hopi Time: A Linguistic Analysis of the Temporal Concepts in the Hopi Language*. Mouton Publishers
- Markosian, N. (2004). A defence of presentism. *Oxford Studies in Metaphysics*, 1(3), 47–82.
- Matsubara, K. (2017). Quantum gravity and the nature of space and time. *Philosophy Compass*, 12(3), e12405.
- Maudlin, T. (2002). Remarks on the passing of time. *Proceedings of the Aristotelian Society*, 102(3), 237–252.
- Maudlin, T. (2007). *The metaphysics within physics*. Oxford: Clarendon Press.
- McGlone, M., & Harding, J. (1998). Back (or forward?) to the future: The role of perspective in temporal language comprehension. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 24, 1211–1223.
- McTaggart, J. E. (1908). The unreality of time. *Mind*, 17, 457–474.
- Mellor, H. (1998). *Real time II*. London: Routledge.
- Miller, K. (2017a). Presentness, Where Art Thou? Self-locating Belief and the Moving Spotlight. *Analysis*, 77(4), 777–788.
- Miller, K. (2017b). A taxonomy of views about time in Buddhist and western philosophy. *Philosophy East and West*, 67(3), 763–782.
- Miller, K., Holcombe, A., & Latham, A. J. (2020). Temporal phenomenology: phenomenological illusion versus cognitive error. *Synthese*, 197, 751–771.
- Moore, K.E. (2006) Space-to-time mappings and temporal concepts. *Cogn. Linguist.* 17, 199–244.
- Moore, K.E. (2011) Ego-perspective and field-based frames of reference: temporal meanings of FRONT in Japanese, Wolof, and Aymara. *J. Pragm.* 43, 759–776.
- Núñez, R. (1999) Could the future taste purple? Reclaiming mind, body, and cognition. *Journal of Consciousness Studies*, 6(11-12), 41-60.
- Núñez, R., Cooperrider, K., Doan, D., & Wassmann, J. (2012). Contours of time: Topographic construals of past, present, and future in the Yupno valley of Papua New Guinea. *Cognition*, 124(1), 25–35.
- Núñez, R., & Cooperrider, K. (2013). The tangle of space and time in human cognition. *Trends in cognitive sciences*, 17(5), 220-229.
- Núñez, R. E., Motz, B. A., & Teuscher, U. (2006). Time after time: The psychological reality of the ego-and time-reference-point distinction in metaphorical construals of time. *Metaphor and symbol*, 21(3), 133-146.
- Núñez, R. & Sweetser, E. (2006) With the future behind them: convergent evidence from Aymara language and gesture in the crosslinguistic comparison of spatial construals of time. *Cogn. Sci.* 30, 401–450
- Paul, L. A. (2010). Temporal experience. *Journal of Philosophy*, 107(7), 333–359.
- Price, H. (1997). *Time's arrow & Archimedes' point: New directions for the physics of time*. Oxford: Oxford University Press.
- Price, H. (2007). Causal perspectivalism. In H. Price & R. Corry (Eds.), *Causation, physics and the constitution of reality: Russell's Republic revisited*. Oxford: Oxford University Press.
- Prosser, S. (2007). Could we experience the passage of time? *Ratio*, 20, 75–90.
- Prosser, S. (2012). Why does time seem to pass? *Philosophy and Phenomenological Research*, 85, 92–116.
- Prosser, S. (2013). Passage and perception. *Nous*, 47, 69–84.
- Rosenkranz, S. & Correia, F. (2018). *Nothing to Come: A Defence of the Growing Block Theory of Time*. Springer Verlag.
- Schlesinger, G. 1982. “Aspects of Time.” *Mind* 91 (361): 141–143.
- Schlesinger, G. (1994). Temporal becoming. In N. Oakland & Q. Smith (Eds.), *The new theory of time*. New Haven, CT: Yale University Press.
- Schuster, M. M. (1986). Is the flow of time subjective? *Review of Metaphysics*, 39, 695–714.

- Shardlow, J., Lee, R., Hoerl, C., McCormack, T., Burns, P., & Fernandes, A. S. (2020). Exploring people's beliefs about the experience of time. *Synthese*, 1-23.
- Sider, T. (2001). *Four-dimensionalism: An ontology of persistence and time*. Oxford, UK: Oxford University Press.
- Sinha, C., & Gardenfors, P. (2014). Time, space, and events in language and cognition: A comparative view. *Annals of the New York Academy of Sciences. Issue: Flow of time*, 40, 1–10.
- Skow, B. (2011). Experience and the passage of time. *Philosophical Perspectives*, 25, 359–387.
- Smith, Q. (1993). *Language and time*. New York: Oxford University Press.
- Smith, Q. 1994. "The Phenomenology of A-Time." In *The New Theory of Time*, edited by L. N. Oaklander and Q. Smith, 351–359. New Haven, CT: Yale University Press.
- Tallant, J. (2012). (Existence) presentism and the A-theory. *Analysis*, 72(4), 673–681.
- Tallant, J. (2018). An error in temporal error theory. *Journal of the American Philosophical Association*, 4(1), 14–32. DOI: 10.1017/apa.2018.5
- Tegtmeyer, E. (1996). The direction of time: A problem of ontology, not of physics. In J. Faye (Ed.), *Perspectives on time*. Dordrecht: Kluwer.
- Tooley, M. (1997). *Time, tense, and causation*. Oxford: Oxford University Press.
- Torrenzo, G. (2017). Feeling the passing of time. *The Journal of Philosophy*, 114(4), 165–188.
- Traugott, E. C. (1978). On the expression of spatio-temporal relations in language. In J. H. Greenberg (ed.), *Universals of human language, vol. 3 : Word structure* (pp. 369-400). Stanford : Stanford University Press.
- Whorf, B. L. (1950). An American Indian model of the universe. *International Journal of American Linguistics*, 16, 67–72.
- Williams, C. 1998. B-time Transition. *Philosophical Inquiry* 20(3/4): 59–63.
- Williams, C. 2003. Beyond A- and B-Time. *Philosophia* 31(1): 75–91.
- Zimmerman, D. W. (2008). The privileged present: defending an "A-theory" of time. In T. Sider, J. Hawthorne, & D. W. Zimmerman (Eds.), *Contemporary debates in metaphysics* (pp. 211–225). Oxford: Blackwell.