**Do the Folk Represent Time as Essentially Dynamical?**

**Abstract**

Recent research (Latham, Miller and Norton, ms) reveals that a majority of people represent actual time as dynamical. But do they, as suggested by McTaggart and Gödel, represent time as *essentially* dynamical? This paper distinguishes three interrelated questions. We ask (a) whether the folk representation of time is *sensitive* or *insensitive*: i.e., does what satisfies the folk representation of time in counterfactual worlds depend on what satisfies it actually—sensitive—or does is not depend on what satisfies it actually—insensitive, and (b) do those who represent actual time as dynamical, represent time in all possible worlds as dynamical—what we call insensitive dynamism—or do they represent time in all possible worlds as dynamical *only conditional on the actual world in fact being dynamical*—what we call sensitive dynamism and (c) do dynamists and non-dynamists deploy two different representations of time, or deploy the same representation, but disagree about what actually satisfies that representation? We found no evidence that the folk representation of time is sensitive, or that the folk representation of time is essentially dynamical in either sense, though we did find evidence of a shared representation, on which dynamical features are sufficient, but not necessary, for time.

**1. Introduction**

Since at least as far back as McTaggart (1908), appeals have been made to the folk representation,[[1]](#footnote-1) concept, or theory, of time. We will talk of a folk representation of time, and the content of that representation, but we could talk about a folk or naïve theory of time[[2]](#footnote-2) or a folk concept of time. McTaggart (1908), and following him, Gödel (1949), suggested that our folk representation of time is a representation of something essentially dynamical,[[3]](#footnote-3) and who each, on that basis, concluded that there is no time (and necessarily so) since nothing could be dynamical in that way. Others have drawn different conclusions, but have agreed that it is conceptually necessary that time passes (Williams 1998; 2003).[[4]](#footnote-4)

At the very least, many dynamists, and some non-dynamists, think that dynamism gets *something* *right* about the way we ordinarily think about time.[[5]](#footnote-5) Dynamists conclude that this gives us defeasible reason to embrace dynamism.[[6]](#footnote-6) Even non-dynamists often concede that they incur the burden of explaining why dynamism gets *something* right about how we ordinarily think about time, given that time is not in fact dynamical.[[7]](#footnote-7)

The claim that dynamism gets something right about the folk representation of time requires unpacking. To do so, we need to articulate some central notions to which we will appeal.

First, we take a representation *of actual time* to be something like a (mental) model of the way the actual world is, with regard to time. Philosophical models of time—presentism, the growing block theory, the block universe model and so on—are examples of such models. We make no assumption that non-philosophers’ representations of actual time are as complete or consistent as these models, but do assume that these representations can be more, or less, similar to these philosophical models. We will call those who represent actual time as being more similar to a dynamical than a non-dynamical model, *dynamists*, and those who represent actual time as more similar to a non-dynamical than a dynamical model, *non-dynamists.*

By a representation *of time* we mean a representation of *what it is for something to be time*. Sometimes called a folk *concept* of time,[[8]](#footnote-8) this representation is what guides (or perhaps is constituted by) people’s dispositions to make judgements about whether some actual, or counterfactual, world, contains time. A representation of time, then, outstrips a representation of actual time. The latter is a representation of how actual time is taken to be; the former is a representation of what it is to be time: of what is *essential* to time.

We suppose that representations can be tacit, insofar as individuals who employ those representations may not be able clearly to articulate their content, let alone provide anything like necessary and sufficient conditions for something to *satisfy* those representations (i.e. answer to the content of those representations). Nonetheless, we assume that people’s behaviour—linguistic and otherwise—provides some evidence for the content of even tacit representations. If we describe a world to you, in a way that does not mention temporal relations, and ask, ‘is this world one that contains time?’ you will use your (likely tacit, unless you are a philosopher) representation of time, to decide whether or not it contains time. Prior to considering this question, you may have had no explicit view as to whether that world contains time. Nevertheless, there is something about you which means that if you were are asked that question, you would say one thing, or another (or have no idea at all). In effect, what we have just described is a simplified version of the methodology we deploy in the studies we describe in §3.

We begin, in §2, by outlining extant research regarding the content of the folk representation of time and disambiguating a number of distinct questions regarding whether the folk represent time as something that is essentially dynamical. It is important to bear in mind that our aim is to address these more specific questions, not to fully explicate the content of the folk representation of time. It is also important to note that we do not assume that there is a unique, shared, folk representation of time even amongst the population we tested. Indeed, as we will see (§2), previous empirical research suggests that there may be several representations present in this population. One of the questions we aim to address is whether there is evidence that dynamists and non-dynamists share a representation, or employ two distinct representations. Nevertheless, for now we will talk of ‘the’ folk representation of time.

It is also important to note the limitations of this research. Social scientists have found cross-cultural and cross-linguistic differences across a broad variety of tasks that are relevant to people’s representation of time (more on this below), though whether this shows a difference in the underlying representation of time, or merely in the ways in which people describe that representation in language and gesture, is unclear (for discussion see Callender, 2017). Our sample population is drawn exclusively from the US, and we make no claims regarding whether our results generalise to other, quite different, populations. So everything we say ought be relativised to the population we sampled.

Bearing this in mind, §3 outlines our methodology and analyses. §4 presents our discussion of these results. Interestingly, our results suggest that non-dynamists have been too concessive; only a small subpopulation of the population tested think that dynamism is necessary for time, and, indeed, another small subpopulation thinks that dynamism is *incompatible* with there being time.

**2. The folk representation of time**

There has been a good deal of social science research into the ways in which people talk about, use gestures, language, and written diagrams, to represent time (see Evans, 2003:14; Sinha and Gardenfors, 2014; Boroditsky, Fuhrman, and McCormick, 2011; Fuhrman, McCormick, Chen, Jiang, Shu, Mao, and Boroditsky, 2011; Chen, 2007; Boroditsky, 2001; Casasanto and Bottini, 2014; Núñez, Cooperrider, Doan, and Wassmann, 2012). This research, however, has not targeted the key question with which this paper concerns itself: namely, whether the folk representation of time is a representation of something essentially dynamical. Recent research in experimental philosophy goes a little further towards this aim. Latham, Miller and Norton (ms) recently investigated US residents’ representation of actual time by presenting participants with vignettes and asking which vignette participants think describe a universe that is most like our own. Their first experiment found that 14.5% chose the moving spotlight theory, 17.4% chose presentism, 34.3% chose the growing block, 17.2% chose the block universe, 9.3% chose the C-theory and 7.3% chose the quantum gravity universe. In the second experiment, this distribution of results was somewhat different, though across both experiments there were robust results which showed that ~70% of people represent *actual* time as dynamical and ~30% represent it as non-dynamical.

They concluded that participants’ representations of actual time robustly track the difference between dynamical and non-dynamical models, but may not be sufficiently developed for participants to be sure which dynamical, or non-dynamical, model is most like our world. Hence they concluded that there is reason to suppose that there are at least two folk representations of actual time amongst the population they tested (US residents): one dynamical and one non-dynamical. That provides *prima facie* reason to suppose there to be at least two representations *of time*, amongst the population we sampled. We return to this issue shortly. First, we clarify the key question we investigate: namely whether the folk representation of time is a representation of something essentially dynamical.

Let us say that a property, P, is essential to *folk time,* just in case necessarily, the folk representation of time is satisfied by something only if that something has that property. Hence dynamical properties are essential to folk time iff in every world, something satisfies the folk representation of time only if that thing has dynamical properties. To determine whether this is so, we need to know whether what satisfies people’s representation of time in both actual, and counterfactual, worlds, is something that has dynamical properties.

It matters, then, whether what satisfies the folk representation of time counterfactually, depends on what satisfies it actually—the representation is s*ensitive*—or whether what satisfies it actually is insensitive to (i.e. does not depend on) what satisfies it actually—the representation is *insensitive*. Natural kind concepts are paradigmatic sensitive concepts: something satisfies the concept, of say, water, counterfactually, just in case that something is micro-physically just like whatever actually satisfies that concept. Similarly, it has been suggested that phenomenal concepts have complicated sensitive content. Hawthorne (2002) and Braddon-Mitchell (2003) suggest that our phenomenal concepts are concepts according to which if actually there are dualistic properties accessible through revelation, then phenomenal properties are those properties, and necessarily so. Otherwise, phenomenal properties are just whichever properties play certain functional roles.

We can now disambiguate the claim that people’s folk representation of time is a representation of something essentially dynamical. One disambiguation is the *insensitively-dynamical* thesis: the claim that regardless of what satisfies the representation actually, the representation only satisfied in dynamical worlds. McTaggart and Gödel endorse this thesis. This thesis predicts that people will judge that there is time only in dynamical worlds, regardless of whether the actual word is dynamical or not, and so if actually there are no dynamical properties, it predicts that people will be error theorists about actual time.

The second disambiguation is the *sensitively-dynamical* thesis: the claim that what satisfies that representation, in every world, is something dynamical, but *only* *if* what actually satisfies that representation is dynamical. Baron and Miller (2015a; 2015b) consider this view.[[9]](#footnote-9) This thesis predicts that if people believe that the actual world is dynamical, they will judge that there is time actually, and will judge that there is time only in counterfactual dynamical worlds, but if they believe that the actual world is non-dynamical, they will judge that there is time actually, and will judge that there is time in both dynamical and non-dynamical counterfactual worlds.

Both the sensitively-dynamical and insensitively-dynamical theses are disambiguations of the hypothesis that the folk represent time as essentially dynamical. The alternative hypothesis is that the folk represent time as not essentially dynamical. A natural view of this kind is that the folk representation is one on which the presence of dynamical properties is *sufficient*, but not *necessary*, for there to be time, and that is so regardless of whether our world is dynamical or not (the representation is insensitive). Call this the *insensitively-dynamically-sufficient* thesis. This thesis predicts that people will judge that there is time in both dynamical and non-dynamical worlds, regardless of whether the actual world is dynamical or non-dynamical.

Each of these three theses presupposes that there is a unique, shared, folk representation of time. In what follows we address two questions. First, is there a unique shared folk representation of time (shared representation thesis) or not (multi-representation thesis) and if so, which, if any, of these three theses is correct about the content of that shared representation? Second, if there is no shared representation, then what is the distribution, amongst the population we test, of people who employ an insensitively-dynamical, a sensitively-dynamical, or an insensitively-dynamically-sufficient, folk representation of time?

In order to do so, we distinguish scenarios considered as actual, from scenarios considered as counterfactual. We take scenarios considered as actual to be ways the actual world might turn out to be, for all we know: that is, ways we cannot rule out *a priori*. As such, scenarios need not describe genuinely possible worlds. So for instance, perhaps dynamical worlds are metaphysically impossible, and so a description of a dynamical scenario, considered as actual, is not the consideration, as actual, of a possible world. That is why we use the term ‘scenario’, rather than ‘world’. Then one considers a dynamical scenario as actual when one supposes that it turns out, or one discovers that, the actual world is dynamical. For the purposes of our studies, we ask participants to suppose that they *discover* that our universe (the term we use in the vignettes) is some particular way; this corresponds to them considering some scenario as actual. We then ask participants to respond to certain questions about the actual universe, on the assumption that they make that discovery.

By contrast, scenarios considered as counterfactual are simply scenarios that are counterfactual relative to some scenario that is taken to be actual. (Again, such scenarios might not be possible, if the scenario considered as actual is not possible). For the purposes of this study, we asked participants about universes that are specified to ***not*** be our universe; this corresponds to them considering some scenario as counterfactual. Importantly, when we ask participants questions about universes that are not our own, we always do so after we have asked them to suppose that our universe is discovered to be some particular way. That is, we ask people their views about counterfactual scenarios, conditional on them taking some scenario to be actual. For instance, we ask participants whether they think there is time in a different universe from ours which is non-dynamical, after they are told that (for instance) it turns out that our universe is dynamical. This is to consider a non-dynamical scenario as counterfactual, conditional on taking a dynamical scenario to be actual.

We assume that what individuals say, across a range of scenarios, regarding what satisfies their representation, is defeasible evidence regarding the content of that representation. It is defeasible because we ask participants questions about our universe, and other universes, where sometimes we are asking them these questions conditional on our universe being different from the way they actually suppose it to be. What participants say, in these experimental scenarios, is only defeasible evidence regarding what they would, *in fact,* say, were they to make those discoveries about the actual world since people may not be fully adept at simulating what they *would* say, *were* they to make certain actual discoveries, given that in fact they do think that they will make such discoveries.

One might worry that participants will find it difficult to imagine that our universe is other than they in fact take it to be, and more difficult again to imagine counterfactual universes, conditional on our universe being other than they in fact take it to be. We return to this issue in §4. For now, we note that there are previous studies that use this kind of methodology in the domain of free will, in which participants are asked to evaluate scenarios in which determinism is true, and asked to evaluate scenarios in which indeterminism is true (Nahmias, Mossis, Nadelhoofer, and Turner, 2005; 2006; Nichols and Knobe, 2007); are asked to evaluate scenarios in which *actually* determinism is true or *actually* indeterminism is true, and scenarios in which *counterfactually*, determinism is true, and *counterfactually*, indeterminism is true (Roskies and Nichols 2008); and asked to evaluate deterministic scenarios *conditional* on indeterminism being true, and to evaluate indeterministic scenarios *conditional* on determinism being true (Latham 2019). In all these cases, results suggested that people were able to engage in this task. That provides *prima facie* evidence that non-philosophers are at least somewhat able to imaginatively entertain our world being other than they take it to be, and to evaluate counterfactual worlds on that basis.

Let’s return to the question of whether we ought think there is a shared folk representation of time. We noted, previously, that the prior study of Latham et al. seems to suggest that there will be at least two such representations. In fact, matters are more complicated than that. Latham et al.’s results are consistent with there being a shared folk representation of time: but they are not consistent with all three theses about the content of that representation. Since Latham et at found that ~30% of the population represent actual time as non-dynamical, it follows that this 30% of people do not employ an insensitively-dynamical representation. So we already know that, as stated, the insensitively-dynamical thesis is false. It could still be, of course, that the multi-representation thesis is true, and a large percentage of the population–i.e. the dynamists—employ this representation.

By contrast, Latham et al.’s results are consistent with there being a shared representation whose content is sensitively-dynamical, or insensitively-dynamically-sufficient. Call the former the shared sensitively-dynamical thesis, and the latter the shared insensitively-dynamically-sufficient thesis. The former predicts that if we specify what the actual world is like (dynamical or non-dynamical) both dynamists and non-dynamists make the same judgements about counterfactual scenarios, conditional on the actual world being that way. It also predicts that dynamists and non-dynamists will disagree about counterfactual scenarios, conditional on the former being told that our world is dynamical, and the latter being told that it is non-dynamical. By contrast, the shared insensitively-dynamically-sufficient thesis predicts that both dynamists and non-dynamists will make the same judgements about actual and counterfactual scenarios, regardless of whether they are told that the actual world is dynamical or non-dynamical.

Bearing all this in mind, let’s make some predictions. Many philosophers have thought that dynamism gets something right about *the* folk representation of time. This suggests that they hold that there is a shared representation (shared representation thesis) and that this representation represents something essentially dynamical (sensitively or insensitively-dynamical thesis). Since Latham et al.’s previous findings are inconsistent with the insensitively-dynamical thesis, this gives us reason to predict that we will find evidence consistent with the shared sensitively-dynamical thesis.

Overall, then, we predicted (a) that we would find a statistically significant difference in the pattern of responses to scenarios considered as counterfactual between those who were told that a dynamical scenario is actual, and those who were told a non-dynamical scenario is actual (sensitivity) and (b) that both dynamists and non-dynamists will agree that if a dynamical scenario is actual there is time in that scenario, and there will be no statistically significant difference between their levels of agreement and (c) both dynamists and non-dynamists will agree that there no time in a non-dynamical scenario considered as counterfactual, if a dynamical scenario is actual, and there will be no statistically significant difference between their levels of agreement and (d) both dynamists and non-dynamists will agree that if a non-dynamical scenario is actual, then there is time in that scenario, and there will be no statistically significant difference between their levels of agreement and (e) both dynamists and non-dynamists will agree that there *is* time in non-dynamical scenarios considered as counterfactual, if a non-dynamical scenario is actual, and there will be no statistically significant difference between their levels of agreement.

**3. Experimental Design and Results**

In both experiments we aimed to determine (a) what participants *in fact* think our world is like: dynamical or non-dynamical and (b) what participants say about whether a dynamical or non-dynamical scenario contains time, if they discover that scenario to be actual (where that discovery can either accord with what they in fact think the world is like, or can fail to accord with what they think our world is like) and (c) what participants say about whether a dynamical or non-dynamical counterfactual scenario contains time, conditional on discovering that a dynamical, or non-dynamical, scenario is actual. In effect, then, we have a three-way index: what people in fact think our world is like; whether people think there is time in a scenario, when imagined to be actual, and whether people think there is time in some counterfactual scenario, given that they take some scenario (dynamical or non-dynamical) to be actual.

In each experiment we presented participants with pairs of vignettes. One vignette describes a dynamical scenario, and one describes a non-dynamical scenario. To gain information about what participants think our world is in fact like, they read both vignettes and then say which they think is most like our world. Participants then see one of the vignettes again (which they see first is randomised) and are told that scientists have discovered that our universe is just like the universe described in the vignette. They are then asked whether the vignette describes a universe that contains time. The process is then repeated for the second vignette. This gives us information about what people say about whether there is time in a scenario considered as actual. It also allows us to see what people say about there being time in a scenario, considered as actual, given what they *in fact* think the actual world is like. Finally, in each experiment, all participants see both vignettes side by side. But in one condition participants are told that vignette 1 is the actual universe, and vignette 2 is a parallel universe (i.e. counterfactual scenario) and in the other condition participants are told that vignette 2 is the actual universe, and vignette 1 is a parallel universe. In both conditions participants are then asked whether there is time in the parallel universe.

Given our aims, it was important that the scenarios described did not explicitly mention time, times, or temporal relations, or otherwise use temporal locutions. For instance, if a scenario is described in terms of there being events that are earlier-than, and later-than, other events, this strongly suggests that there is time in that scenario. Hence we wrote the vignettes in ‘time-neutral’ form: describing the scenarios without using temporal locutions. Since this makes it difficult to visualise (or otherwise conceptualise) the scenarios in question, we introduced the locution: ‘some scientists, philosophers and theologians in Universe [C/D/E] think that…’ where the ellipses included a description of the scenario using temporal language. Our aim was to provide both a time-neutral and non-neutral description of the scenarios, so that participants could then bring to bear their representation of time to determine whether they think there is time in the scenario thus described.

Due to this, we had concerns that participants might not understand the vignettes. We did two things to check whether this was so. First, we used vignettes that were minimally amended from those used by Latham et al. We re-ran the Latham et al. study using time-neutral variants of their 6 vignettes (only three of which are used in the present two experiments), asking participants which of the universes described is most like our universe. We reasoned that if the distribution of participants across the time-*neutral* vignettes was similar to Latham et al.’s results, this would go some way towards showing that participants understood the vignettes as intended. The distributions were similar.[[10]](#footnote-10) Second, we included three comprehension questions at the end of the vignettes, and the results we report only include those from participants who got at least 2 out of 3 of the questions correct.

**3.1 Experiment 1 Method**

*3.1.1 Participants*

421 people participated in the study. Participants were U.S. residents, recruited and tested online using Amazon Mechanical Turk, and compensated $2 for approximately 20 minutes of their time. 64 participants had to be excluded for failing to follow task instructions. This means that they failed to answer the questions (55), or failed an attentional check question (9). The remaining sample was composed of 357 participants (aged 20-99; 150 female). Mean age 35.30 (SD = 11.87). Ethics approval for this study was obtained from the [blanked] Human Research Ethics Committee. Informed consent was obtained from all participants prior to testing. The survey was conducted online using Qualtrics.

*3.1.2 Materials and Procedure*

Participants see a total of four conditions. Condition 1: actual dynamical scenario; condition 2: actual non-dynamical scenario; condition 3: actual dynamical scenario, with *counterfactual* non-dynamical scenario; condition 4: actual non-dynamical scenario, with *counterfactual* dynamical scenario. All participants begin by reading both vignettes, which are as follows:

The time-neutral dynamical (presentist) scenario:

Imagine a universe (Universe C) in which the distance relations between objects are purely spatial. Spatial relations are relations such as Mike being two feet from Lily, or Boston being 16000kms from Sydney. In this world any two objects are separated by some spatial distance, and no two objects are separated by any other distance relations. Since in Universe C there are only three spatial dimensions, Universe C is a giant three dimensional object. In Universe C, which objects exist, and what properties those objects have, *changes.* So Universe C is a giant *changing* three dimensional object. Some scientists, philosophers and theologians in Universe C think that everything that exists—everything that is part of the giant three dimensional object—is in the objective present. They think that objects that existed in the past no longer exist, and that objects that will exist in the future do not yet exist.

 For example, in Universe C there are two particles, P1 and P2. In this universe, there is an event of P1 hitting a particle detector and an event of P2 hitting that particle detector. But when the event of P1 hitting the particle detector exists, the event of P2 hitting the particle detector does not exist, and when the event of P2 hitting the particle detector exists, the event of P1 hitting the particle detector does not exist. In Universe C events can be ordered in terms of their coming into, and out of, existence. This ordering of events has a single, correct, direction. In this case, the event of P1’s hitting the detector is prior, in the ordering, to the event of P2’s hitting the detector. Or, as we might say, the direction goes *from* P1’s hitting the detector, *to* P2’s hitting the detector (not from P2’s hitting the detector to P1’s hitting the detector).

Participants are then presented with the following comprehension questions:

1. Scientists in Universe C think that the present is real, the past and future are not.
2. Scientists in Universe C think that which events are present, changes.
3. Scientists in Universe C think that some past events are present.

The time-neutral non-dynamical (B-theoretic) scenario:

Imagine a universe (Universe B) where a single set of events exists. All these events are equally real. The sum total of reality never grows or shrinks, so the totality of events that exist never changes. These events bear certain relations to one another and these relations between events in Universe B are fixed and never change. It is possible to order the events in that universe in terms of these relations. Some scientists, philosophers and theologians in Universe B think these relations are the relations of earlier-than, later-than, and simultaneous-with. In Universe B no set of events is special. Every event is present from the perspective of those located at it, just as every location is ‘here’ from the perspective of those located at it.

For example, in Universe B there are two particles, P1 and P2. In this universe, there is an event of P1 hitting a particle detector, and an event of P2 hitting that particle detector. The event of P1 hitting the particle detector is prior, in the ordering, to the event of P2 hitting the detector. That relation never alters; it is always the case that the event of P1 hitting the detector is prior to the event of P2 hitting the detector. Or, as some of the scientists, philosophers and theologians in Universe B would put it, the event of P1 hitting the detector is earlier than the event of P2 hitting the detector. The ordering of events that is generated via these relations has a single, correct direction. In this case, it goes *from* P1’s hitting the detector *to* P2’s hitting the detector (not from P2’s hitting the detector to P1’s hitting the detector).

Participants are presented by with the following comprehension questions:

1. Scientists in Universe B think that the present is real, the past and future are not.
2. Scientists in Universe B think that the present moves from earlier time to later times. For instance, they think the present was one located in the year 1009, and is now located in the year 2019, and will be located in the year 2100.
3. Scientists in Universe B think that the present is just whichever time one is at. For instance, they think that presentness does not move from earlier times to later times. Every time is present to the individuals located at that time.

After reading both vignettes, participants are asked the question: “which universe do you think is most like our own?” and are given two options to choose from: Universe C and Universe B. They are then asked to indicate their level of confidence in that judgement, on a Likert scale of 1 (very unsure) - 7 (very sure). Participants who answered two or more of the comprehension questions incorrectly, about the vignette they thought was most like our universe, were excluded from all of the analyses. At no point could participants return to a previous screen. Those we subsequently refer to as dynamists are those who chose universe C, and those we refer to as non-dynamists are those who chose universe B, as being most like our universe.

Participants then see both vignettes (on separate screens) in random order. For each vignette, they are asked to imagine that that universe described has been discovered to be just like the actual universe. They are then presented with the statement “there is time in Universe [C/B]” and asked how strongly they agree/disagree on a Likert scale of 1 (strongly disagree) - 7 (strongly agree). Participants then see both vignettes side by side. In random order, participants are told that universe C is just like the actual universe, and universe B is a parallel universe, and told that universe B is just like the actual world, and universe C is a parallel universe. The instructions are the following “imagine scientists discover that the *actual*Universe (the one where you and I live) is exactly like Universe [**C**/B]. Now imagine scientists are suddenly able to observe a *parallel* Universe. The parallel Universe is like the actual universe in many respects: it contains many of the same things as our universe. However, the *parallel* Universe is exactly like Universe [C/**B**]. The scientists are right about this: the actual Universe is exactly like Universe [**C**/B] and the parallel Universe is exactly like Universe [C/**B**]. Imagining that is the case, please answer the following question about the *parallel* Universe. Remembering that the actual universe is just like Universe **[C**/B], and the parallel universe is just like Universe [C/**B]**.” Participants are then asked to indicate their level of agreement, on a Likert scale of 1-7, with the following statement: “there is time in the parallel universe.” They are then asked to indicate their level of confidence in their previous judgement.

**3.2 Experiment 2 Method**

*3.2.1 Participants*

411 people participated in the study. Participants were U.S. residents, recruited and tested online using Amazon Mechanical Turk, and compensated $2 for approximately 20 minutes of their time. 61 participants had to be excluded for failing to follow task instructions. This means that they failed to answer the questions (55), or failed an attentional check question (6). The remaining sample was composed of 350 participants (aged 18-72; 152 female; 1 prefer not to answer). Mean age 36.71 (SD = 12.00). Ethics approval for this study was obtained from the [blanked] Human Research Ethics Committee. Informed consent was obtained from all participants prior to testing. The survey was conducted online using Qualtrics.

*3.2.2 Materials and Procedure*

The procedure for experiment 2 was just like that for experiment 1, except that the dynamical scenario is a time-neutral vignette describing a growing block. That vignette is below:

Imagine a universe (Universe E) where new events and objects constantly come into existence. The events and objects that come into existence remain in existence, so the sum total of reality grows as new events and objects come to exist. In this universe we can generate an ordering of events in terms of the coming into existence of new events and objects. Some scientists, philosophers and theologians in Universe E think that the set of events and objects that have just come into existence are those that are in the present. They think that as new events and objects come into existence, already existing events and objects become part of the past. They think that no future events and objects exist.

For example, in Universe E there are two particles, P1 and P2. In this universe, there is an event of P1 hitting a particle detector, and an event of P2 hitting that particle detector. When the event of P1 hitting the detector has just come into existence, the event of P2 hitting the detector does not exist; but when the event of P2 hitting the detector has just come into existence, the event of P1 hitting the detector exists.

So some scientists and philosophers in this universe think that when P1’s hitting the detector has just come into existence, P2’s hitting the detector is future and does not exist, and when P2’s hitting the detector has just come into existence, P1’s hitting the detector exists, and is past. In this universe the ordering of events that is generated via the coming into existence of new events and objects has a single, correct, direction. In this case, it goes *from* P1’s hitting the detector, *to* P2’s hitting the detector (not from P2’s hitting the detector to P1’s hitting the detector).

**3.3 Analyses**

*3.3.1 Experiment One Main Results*

Before reporting the statistics and details, let’s begin with a summary of our main findings from experiment one.

First, we predicted that we would find evidence in favour of the shared, sensitively-dynamical thesis. Thus, we predicted that we would find a statistically significant difference in the pattern of responses to counterfactual scenarios when participants were told that the actual scenario is dynamical versus non-dynamical (the world-sensitivity part of the thesis). We found no evidence to support this hypothesis. Which scenario participants are told is actual, had no statistically significant effect on their judgments about time in counterfactual scenarios.

Second, we predicted that both dynamists and non-dynamists would agree that there is time in a dynamical scenario considered as actual, with no statistically significant difference between their levels of agreement. This prediction was partially supported. Both groups judged that there is time in a dynamical scenario considered as actual, but there was a statistically significant difference between their levels of agreement. Both groups gave larger judgments when evaluating a scenario that was most like they *in fact* take the actual world to be. So dynamists tended to give larger judgments when evaluating presentist scenarios, and non-dynamists tended to give larger judgments when evaluating B-theoretic scenarios.

Third, we predicted that both dynamists and non-dynamists will agree that there is no time in counterfactual non-dynamical scenarios, conditional on a dynamical scenario being actual, with no statistically significant difference between their levels of agreement. We do not find this. Overall, participants tended to judge that there was time in *all* the scenarios they evaluated. There was also a statistically significant difference between these groups’ levels of agreement, as a result of participants’ larger judgments when evaluating a scenario that matched what they in fact think the actual world is like.

Fourth, we predicted that both dynamists and non-dynamists will agree that there is time in an actual non-dynamical scenario, and there will be no statistically significant difference between their levels of agreement. This prediction was partially supported. Both groups tended to judge that there was time in the actual non-dynamical scenario. There was, though, a statistical difference between these groups’ levels of agreement, once again as a result of participants’ larger judgments when evaluating a scenario that matched what they in fact think the actual world is like.

Finally, we predicted that both dynamists and non-dynamists will agree that there istime in counterfactual non-dynamical scenarios, if the non-dynamical scenario is actual, with no statistically significant difference between their levels of agreement. Once again, this prediction was only partially supported. Both groups tended to judge that there was time in counterfactual non-dynamical scenarios, if the non-dynamical scenario is actual. However, once again there was a statistical difference between the groups’ levels of agreement, as a result of participants’ larger judgments when evaluating a scenario that matched what they in fact think the actual world is like.

Moving on to the detailed statistics, recall that participants were presented with two vignettes: one corresponding to a dynamical theory—a presentist scenario—and one corresponding to a non-dynamical theory—an eternalist B-theoretic scenario. Of the original 357 participants, 145 participants correctly answered at least 2 of the 3 comprehension questions for *both* the dynamical and non-dynamical vignettes. The results outlined above (and presented below) include only these participants.

80 participants judged that the non-dynamical scenario was most like our world and 65 participants judged that the dynamical scenario was most like our world. There was no significant difference in confidence between the non-dynamists (*M* = 5.08, *SD* = 1.23) and the dynamists (*M* = 5.18, *SD* = 1.22; *t*(143) = -0.535, *p* = .594).

Table 1 reports levels of agreement to the sentence “There is time in Universe [B/C]”. Participants who chose 1-3 on the Likert scale are reported as disagreeing, while participants who chose 5-7 are reported as agreeing. Thus, weak agreement is reported as agreement in what follows.

*Table 1.* *Levels of agreement* *that there is time for different contexts given participants’ belief about the actual world.*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **%Yes** | **%No** | **%4** | **Mean** | **SD** |
| **Group: Presentism is most like the actual world (*N* = 65)** |
| Actual Presentism | 83.1 | 13.8 | 3.1 | 5.60 | 1.56 |
| Counterfactual Presentism (Actual B-Theory) | 75.4 | 15.4 | 9.2 | 5.31 | 1.51 |
| Actual B-Theory | 60 | 32.3 | 7.7 | 4.69 | 1.86 |
| Counterfactual B-Theory (Actual Presentism) | 61.5 | 27.7 | 10.8 | 4.83 | 1.83 |
| **Group: B-Theory is most like the actual world (*N* *=* 80)** |
| Actual Presentism | 70 | 25 | 5 | 4.89 | 1.68 |
| Counterfactual Presentism (Actual B-Theory) | 68.7 | 27.5 | 3.8 | 4.85 | 1.69 |
| Actual B-Theory | 88.7 | 8.8 | 2.5 | 5.68 | 1.27 |
| Counterfactual B-Theory (Actual Presentism) | 87.4 | 8.8 | 3.8 | 5.51 | 1.31 |

Level of agreement was analysed using a repeated-measures ANOVA. The ANOVA included within-subjects factors of context (actual; counterfactual) and theory (presentism; B-theory) and a between-subjects factor of group (dynamists versus non-dynamists). The 2x2x2 repeated-measures ANOVA revealed only a significant interaction effect between theory and group *F*(1, 143) = 24.986, *p* < .001 (see Figure 1). There were no other significant effects.

Simple effects tests using a Bonferroni correction were carried out on the two-way interaction between theory and group. Firstly, levels of agreement for dynamists were significantly larger when evaluating presentist scenarios (*M* = 5.45, *SD* = 1.45) relative to when evaluating B-theoretic scenarios (*M* = 4.76, *SD* = 1.38; *p* = .001). Secondly, levels of agreement for non-dynamists were significantly larger when evaluating B-theoretic scenarios (*M* = 5.59, *SD* = 1.39) relative to when evaluating presentist scenarios (*M* = 4.87, *SD* = 1.45; *p* < .001). Thirdly, for presentist scenarios, levels of agreement were significantly larger for dynamists relative to non-dynamists (*p* = .017). Finally, for B-theoretic worlds, levels of agreement were significantly larger for non-dynamists relative to dynamists (*p* < .001).

*3.3.2 Experiment Two Main Results*

Before reporting the statistics and details, let’s begin with a summary of our main findings from experiment two.

Overall, we predicted that we would find evidence in support of the shared sensitively-dynamical thesis. First, we would find a statistically significant difference in the participants’ pattern of responses to counterfactual scenarios when they are told that a dynamical scenario is actual, than when they are told that a non-dynamical scenario is actual (the “sensitivity” component of the thesis). We found no evidence in support of this hypothesis. Which scenario participants were told is actual, had no statistical effect on their judgments about whether there was time in a counterfactual scenario.

Second, we predicted that dynamists and non-dynamists would agree that there is time in a dynamical scenario considered as actual, with no statistically significant difference between their levels of agreement. This prediction was partially supported. While both groups judged that there is time in a dynamical scenario considered as actual, there was a statistically significant difference between the groups’ levels of agreement. Both groups gave larger judgments when evaluating a scenario that was most like they *in fact* take the actual world to be. So dynamists tended to give larger judgments when evaluating growing block scenarios, and non-dynamists tended to give larger judgments when evaluating B-theoretic scenarios.

 Third, we predicted that both dynamists and non-dynamists will agree that there is no time in counterfactual non-dynamical scenarios, if a dynamical scenario is actual, with no statistically different difference between their levels of agreement. We did not find this. Overall, participants tended to judge that there was time in *all* the scenarios they evaluated. There was also a statistically significant difference between these groups’ levels of agreement, as a result of participants’ larger judgments when evaluating a scenario that matched what they in fact think the actual world is like.

Fourth, we predicted that both dynamists and non-dynamists would agree that there is time in a non-dynamical scenario considered as actual, with no statistically significant difference between their levels of agreement. This prediction was partially supported. Both groups tended to judge that there was time in the non-dynamical scenario considered as actual. There was though, a statistical difference between groups levels of agreement, as a result of participants’ larger judgments when evaluating a scenario that matched what they in fact think the actual world is like.

Finally, we predicted that both dynamists and non-dynamists would agree that there istime in counterfactual non-dynamical scenarios, if a non-dynamical scenario is actual, with no statistically significant difference between their levels of agreement. Once again, this prediction was only partially supported. Both groups tended to judge that there was time in counterfactual non-dynamical scenarios, if a non-dynamical scenario is actual. However, once again there was a statistical difference between group levels of agreement, as a result of participants’ larger judgments when evaluating a scenario that matched what they in fact think the actual world is like.

Moving on to the detailed statistics, recall that participants were presented with two time-neutral vignettes: one corresponding to a dynamical theory—a growing block scenario—and one corresponding to a non-dynamical theory—an eternalist B-theoretic scenario. Of the original 350 participants, 141 participants correctly answered at least 2 of the 3 comprehension questions for *both* the dynamical and non-dynamical vignettes. The results outlined above, and presented below, include only these participants.

79 participants judged that the non-dynamical scenario was most like our world and 62 participants judged that the dynamical scenario was most like our world. There was no significant difference in confidence between non-dynamists (*M* = 5.09, *SD* = 1.54) and dynamists (*M* = 4.97, *SD* = 1.55; *t*(139) = 0.462, *p* = .645).

Table 1 reports levels of agreement to the sentence “There is time in Universe [B/E]”. Participants who chose 1-3 on the Likert scale are reported as disagreeing, while participants who chose 5-7 are reported as agreeing. Thus, weak agreement is reported as agreement in what follows.

*Table 2.* *Levels of agreement* *that there is time for different contexts given participants’ belief about the actual world.*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **%Yes** | **%No** | **%4** | **Mean** | **SD** |
| **Group: Growing Block is most like the actual world (*N* = 62)** |
| Actual Growing Block | 88.7 | 6.5 | 4.8 | 5.89 | 1.38 |
| Counterfactual Growing Block (Actual B-Theory) | 85.5 | 11.3 | 3.2 | 5.71 | 1.43 |
| Actual B-Theory | 69.3 | 24.2 | 6.5 | 5.08 | 1.73 |
| Counterfactual B-Theory (Actual Growing Block) | 70.9 | 22.6 | 6.5 | 4.98 | 1.69 |
| **Group: B-Theory is most like the actual world (*N* =79)** |
| Actual Growing Block | 74.7 | 17.7 | 7.6 | 5.41 | 1.65 |
| Counterfactual Growing Block (Actual B-Theory) | 73.4 | 19 | 7.6 | 5.47 | 1.69 |
| Actual B-Theory | 94.9 | 3.8 | 1.3 | 6.18 | 1.05 |
| Counterfactual B-Theory (Actual Growing Block) | 83.6 | 13.9 | 2.5 | 5.71 | 1.50 |

Level of agreement was analysed using a repeated-measures ANOVA. The ANOVA included within-subjects factors of context (actual; counterfactual) and theory (growing block; B-theory) and a between-subjects factor of group (dynamists versus non-dynamists). The 2x2x2 repeated-measures ANOVA revealed only a significant interaction effect between theory and group *F*(1, 139) = 26.008, *p* < .001 (see Figure 2). There were no other significant effects.

Simple effects tests using a Bonferroni correction were carried out on the two-way interaction between theory and group. Firstly, levels of agreement for dynamists were significantly larger when evaluating growing block scenarios (*M* = 5.80, *SD* = 1.35) relative to evaluating B-theoretic scenarios (*M* = 5.03, *SD* = 1.28; *p* < .001). Secondly, levels of agreement for non-dynamists were significantly larger when evaluating B-theoretic scenarios (*M* = 5.94, *SD* = 1.28) relative to when evaluating growing block scenarios (*M* = 5.44, *SD* = 1.36; *p* = .003). Thirdly, for growing block scenarios, there was no significant difference in levels of agreement between dynamists and non-dynamists (*p* = .118). Finally, for B-theoretic scenarios, levels of agreement were significantly larger non-dynamists relative to dynamists (*p* < .001).

**4. Discussion**

There are three key findings from these studies. In what follows, since we see the same patterns of responses in both studies, we will for the most part talk about the results collectively.

The first interesting finding is that there was no evidence of world-sensitivity with regard to dynamism. Participants’ responses to counterfactual scenarios did not depend on which scenario we told them was actual. In turn, our hypothesis that we would find evidence of a shared sensitively-dynamical folk representation of time was not vindicated: for this is, of course, just one way of having a sensitive concept, something for which we found no evidence.

This data also suggests that the majority of participants do not deploy an insensitively-dynamical representation. Whether participants were told that a dynamical or a non-dynamical scenario is actual, most still judged that there was time in counterfactual non-dynamical scenarios: and most responded in this way regardless of what they *in fact* think the actual world is like. Thus, 70.9% (experiment 2) and 61.5% (experiment 1) of those who in fact think our world is *dynamical*, think that there is time in a counterfactual non-dynamical scenario, *even when they are told that they are right about our world being dynamical*.

Thus although Latham, et al. (ms) found that ~70% of participants represent *actual* time as dynamical, these results show that most of those people employ neither an insensitively-dynamical nor a sensitively-dynamical, representation of time. It is not even true, then, that most dynamists represent time as being essentially dynamical.

Instead, we found evidence against the shared representation thesis and in favour of the multi-representation thesis. First, our results suggest that most—but not all—participants have an insensitively-dynamically-sufficient representation. If participants employ that representation then they should judge that there is time in any scenario, dynamical or non-dynamical, regardless of whether it is considered as actual or counterfactual, and, if it is considered as counterfactual, they should just this regardless of which scenario is taken to be actual That is what we found. This means that most people have a representation of time on which the presence of dynamical properties is sufficient, but not necessary, for there to be time, and the presence of non-dynamical relations is also sufficient for there to be time (though we have no evidence regarding whether relations are necessary, unless one supposes that presentist worlds do not contain non-dynamical relations, in which case the data here suggests that non-dynamical relations (at least of the B-theoretic kind) are not necessary).

Second, our results suggest that there are two smaller sub-populations who employ different representations of time. We found that some dynamists (32.2% in experiment 1; 24.2% in experiment 2) judge that if a non-dynamical scenario is actual, then actually, there is no time. This suggests that there is a small, but substantial, population of dynamists, who employ an insensitively-dynamical representation. Equally, we found that some non-dynamists hold that if a dynamical scenario is actual, then actually there is no time (25% in experiment 1; 17.7% in experiment 2). This suggests that these non-dynamists employ an insensitively-*non*-dynamical representation: i.e., one according to which only non-dynamical scenarios contain time, regardless of which scenario is actual.

Overall, then, the majority of the population employ an insensitively-dynamically-sufficient representation, and the remaining smaller population is divided into two: those who employ an insensitively-*dynamical* representation, and those who deploy an insensitively-*non*-dynamical representation. It is, therefore, not the case that there is a unique shared folk representation of time that represents time as essentially dynamical; it is not even the case that a majority of the population employ such a representation.

That brings us to a second interesting finding. Although we found no evidence of world-sensitivity, we did find that what participants *in fact* think the actual world is like, has an effect on how they judge counterfactual scenarios, *regardless of which scenario they have been told is actual.* This is an intriguing finding. One possibility is that participants were unable entirely to shift their context of assessment to some scenario that is stipulated to be actual, where that scenario is not in fact how they suppose the actual world to be. Henceforth we will call this a failure properly to shift context.

If participants failed properly to shift context then when non-dynamists were asked about counterfactual scenarios, conditional on a dynamical scenario being actual, they were still responding *as though* the actual scenario is non-dynamical, and likewise *mutatis mutandis* for dynamists. If so, then our data provides no evidence regarding the world-sensitivity of the folk representation of time, since participants were always evaluating counterfactual scenarios from the perspective of the way they in fact take the actual world to be. There is some reason to suppose this might be so.

Consider the dynamists. In experiment 1, 60% of these participants think that a non-dynamical scenario, considered as actual, contains time. A very similar proportion (61.5%) think there is time in a counterfactual non-dynamical scenario, conditional on a dynamical scenario being actual. We find a very similar pattern in experiment 2 (69.3% and 70.9% respectively). This is surprising. Roughly the same percentage of dynamists think that there is time in a non-dynamical scenario considered as actual, as think there is time in a counterfactual non-dynamical scenario conditional on a dynamical scenario being actual. *Prima facie*, one would have expected more dynamists to judge that there is time in a non-dynamical actual scenario, than in a counterfactual non-dynamical scenario if a dynamical scenario is actual.

We find a similar pattern amongst non-dynamists. In experiment 1, 70% of non-dynamists think there is time in a dynamical scenario considered as actual, while 68.7% think there is time in a counterfactual dynamical scenario, if a non-dynamical scenario is actual. We find the same pattern in experiment 2 (74.7% and 73.4% respectively).

This might be taken as evidence that dynamists might be holding fixed that the actual world is as they in fact take it to be, i.e. dynamical, and evaluating any other scenario, whether they are told it is actual, or counterfactual, as if it were counterfactual. *Mutatis mutandis* for the non-dynamist.

On the other hand, although this pattern of responding is consistent with the hypothesis that participants are not properly shifting context, that is not the only potential explanation. If participants have an insensitive representation, and, in particular, if there are a number of different such insensitive representations in the population, then this is also the pattern we would expect: after all, an insensitive representation is one on which *it does not matter* whether one considers a scenario as actual, or counterfactual. So if people employ insensitive representations, we would also anticipate a pattern of responses that looks like this.

Moreover, our results are puzzling if we assume that they stem from participants failing properly to shift contexts. Fewer non-dynamists think that there is time in a counterfactual *dynamical* scenario, than in either an actual or counterfactual *non*-dynamical scenario. Even if participants are poor at shifting contexts, non-dynamists ought not be *less* likely to judge that there is time in dynamical counterfactual scenarios than in non-dynamical counterfactual scenarios. After all, if they are failing to shift contexts, then they are holding fixed that the actual world is non-dynamical, and evaluating all dynamical scenarios as counterfactual. If dynamical scenarios are even *at least* as good a deservers to satisfy their folk representation of time as are non-dynamical scenarios (and the sensitively-dynamical hypothesis predicts that they are *better* deservers) then non-dynamists should be at least *equally* likely to think that there is time in counterfactual dynamical scenarios as in counterfactual non-dynamical scenarios. This suggests that our failure to find of sensitivity is not best explained by participants’ failure to properly shift context. Finally, given the evidence of a capacity for participants to properly shift contexts from studies undertaken in the free will literature (see §2) we think there is no reason to conclude that participants failed to property shift context.

**5. Conclusion**

Our results show that arguments for temporal dynamism that proceed via a claim about the folk, or ordinary, view of time, must be carefully evaluated. Arguments that intend to show that there is defeasible reason to endorse a dynamical theory of the actual world because most people represent actual time as dynamical, are consistent with our results (though whether such arguments are good is another matter). By contrast, arguments that intend to show that dynamism is necessarily, and hence actually, true because non-dynamism is somehow conceptually impossible—because a non-dynamical world would not, in fact, given our folk representation of time, be a world containing time at all—are not consistent with our results. These results show clearly that most of the population tested do not employ a representation of time on which non-dynamical worlds fail to contain time. Thus, we conclude that the folk do not represent time as essentially dynamical.

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1. By a representation we just mean a contentful state that can be a constituent of thought. [↑](#footnote-ref-1)
2. Callender (2017) speaks of a naïve theory of time. [↑](#footnote-ref-2)
3. Dynamists (or A-theorists) hold that events are ordered in terms of whether they are objectively past, present or future; the location of events within that ordering is dynamic in that a set of events, *E*, is future, will be present, and will then become past and this constitutes the flow of time. By contrast, non-dynamists deny that there are objective properties of pastness, presentness or futurity; all that exists is an ordering of events in terms of the relations of earlier-than, later-than and simultaneous-with, and hence there is no temporal flow. [↑](#footnote-ref-3)
4. Of course, there are many temporal dynamists who think that it is essential to time that it flows, but who do think that this is a conceptual necessity. It might simply be, as a matter of metaphysics, that the A-series is essential to time.

It is often unclear exactly what view different A-theorists take on this matter. For instance, Smith (1993), Gale (1968) Ludlow (1999) and Schlesinger (1982) think that we must posit an A-series because we cannot reduce A-theoretic talk to B-theoretic talk plus indexicals. If we think that our concept of time is intimately connected to our ways of talking about time and our position in it, then if A-theoretic talk is not reducible to B-theoretic talk, this might constitute its being conceptually necessary that time is dynamical. [↑](#footnote-ref-4)
5. See Baron, Cusbert, Farr, Kon, and Miller (2015). [↑](#footnote-ref-5)
6. For arguments of this kind see Zimmerman, (2008) Smith (1994), Craig (2000) and Schlesinger (1994). [↑](#footnote-ref-6)
7. For ways of discharging this burden see Ismael (2012); Callender (2017); Miller, Holcombe and Latham (2018). [↑](#footnote-ref-7)
8. See Baron and Miller (2015(a) and 2015(b)). [↑](#footnote-ref-8)
9. Though they do not defend this claim. Ultimately they defend the view that our representation of time is functionalist. That is not something we tested in this paper. [↑](#footnote-ref-9)
10. Latham et al (experiment 1) found that 14.5% chose the moving spotlight theory, 17.4% chose presentism, 34.3% chose the growing block, 17.2% chose the block universe, 9.3% chose the C-theory and 7.3% chose Quantum Gravity, as being most like our universe. For our minimally modified vignettes, we found that 14.3% chose the moving spotlight theory, 22.7% chose presentism, 17.6% chose the growing block, 27.5% chose the block universe, 12% chose the C-theory and 4.9% chose Quantum Gravity as being most like our universe. While this distribution is not exactly the same as theirs, it is close enough. 600 people participated in the study. Participants were U.S. residents, recruited and tested online using Amazon Mechanical Turk, and compensated $2 for approximately 20 minutes of their time. 86 participants had to be excluded for failing to follow task instructions. This means that they failed to answer the questions (46), or failed an attentional check question (0). The remaining sample was composed of 545 participants (aged 19-70; (226 female; 1 prefer not to answer). Mean age 36.61 (SD = 10.81). Ethics approval for this study was obtained from the [blanked] Human Research Ethics Committee. Informed consent was obtained from all participants prior to testing. The survey was conducted online using Qualtrics. [↑](#footnote-ref-10)