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What is temporal error theory?

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Abstract Much current debate in the metaphysics of time is between A-theorists and B-theorists. Central to this debate is the assumption that time exists and that the task of metaphysics is to catalogue time's features. Relatively little consideration has been given to an *error theory* about time. Since there is very little extant work on temporal error theory the goal of this paper is simply to lay the groundwork to allow future discussion of the relative merits of such a view. The paper thus develops a conceptual framework from within which to evaluate claims about the actual existence, or not, of temporality as that notion appears in folk discourses about time, and from there to examine claims about the counterfactual existence, or not, of temporality so conceived. We subsequently apply this framework to three extant positions drawn from physics and metaphysics that deny the existence of time. We show that only one of these positions is a folk temporal error theory; that is, a view that denies the existence of time as that notion is operative in our everyday thought and talk.

Keywords Time · Metaphysics · Error Theory · Timelessness

1 Introduction

Much current debate in the metaphysics of time is between the A-theorist and the B-theorist. Central to this debate is the assumption that time exists and that the task

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of metaphysics is to catalogue time's features. Relatively little consideration has been given to an *error theory* about time, despite the fact that recent work in physics and philosophy has led some physicists and philosophers to defend such a view (see, for example, Barbour 1994a, b, 1999; Barbour and Isham 1999; Deutsch 1997; Rovelli 2004, 2007, 2009; Tallant 2008, 2010). As we will understand it, a discourse is error theoretic just in case that discourse is truth-apt and core statements asserted by the discourse are false. Temporal error theory is thus the view that temporal discourse is truth-apt and literally false. One reason to suppose it is literally false is if its core statements quantify over properties or objects that do not exist: namely times or temporal properties. Thus one might have reason, drawn either from metaphysics or physics, to think that times or temporal properties fail to exist and therefore that temporal error theory is true.

According to Healey (2002) some physical theories are genuinely error theoretic about time. He goes on to argue that if one adopts temporal error theory one ought to believe that time is a secondary quality akin to *taste* and *colour*. Smolin (2013), by contrast, argues that although contemporary physics seems to deliver us timelessness, as Healey suggests, in fact we have good reason to embrace a view of our world according to which time is not only real, and dynamical, but fundamental. For, he argues, the view that our world is timeless is explanatorily deficient.

Although the work by Healey and Smolin is insightful it can be perplexing. On the one hand, Healey has not told us what it would take for temporal error theory to be vindicated. On the other hand, in order to properly evaluate Smolin's argument for realism we need to know what he means, and what he takes other physicists to mean, when they say contemporary physics implies that there is no time. We then need to know whether what physicists mean when they say there is no time (and what Smolin denies) is something that would, if true, lead us all to conclude (philosophers and folk alike) that time does not exist.[1] In both cases what we are missing is a conceptual framework for assessing physicists' and philosophers' claims that there is no time. Accordingly, the current paper develops a conceptual framework within which to elaborate and understand an error theory about the everyday notion of time. This framework is then applied to three views from physics and metaphysics that claim to offer a timeless account of the universe. We argue that only one of these accounts implies that the everyday notion of time is grossly in error.

Our focus, then, is on *folk temporal error theory*. We recognise that there exists a broader structure of (at least) three levels of theory: physical, metaphysical and folk. All three levels of theory deploy a concept of time. They might deploy the same concept; but it is unlikely. A physical temporal error theory will be one according to

[1] In fact it is unclear what Smolin has in mind. Sometimes he seems to think that contemporary physics implies that there is no time because it tells us that the *fundamental* nature of the world is timeless; sometimes he seems to think it implies that there is no time because it implies that the block universe is true; and sometimes he seems to think that contemporary physics implies that there is no time because it implies that the laws of nature can be projected, from any time, to tell us what the world is like at every other time. Even if the world is as Smolin supposes contemporary physics implies, this is not a way that most metaphysicians (A-theorists aside) would suppose implies that there is no time.

which, given a particular physical concept of time—that is, a concept that is defined by its usage in contemporary theories in physics—it turns out that nothing in our world satisfies that concept given certain suppositions about the physics of our world. Similarly, a metaphysical error theory is one according to which, given some metaphysical concept of time—that is, a concept that is defined by its usage in contemporary metaphysical theories—there is nothing satisfying that concept given certain physical or metaphysical suppositions about the world. These two versions of temporal error theory are interesting and clearly connected to the folk error theory we develop. One might, for instance, hold that while nothing satisfies our physical concept of time, nevertheless something satisfies our metaphysical concept of time. Thus one might be a physical, but not a metaphysical, temporal error theorist. It seems possible that one might even be a realist about what we might call 'physical time' but be a metaphysical temporal error theorist.

Things might be more complicated still: there may be many different physical concepts of time, and many different metaphysical concepts and it may not be possible to say what the 'correct' concept is, for that will likely vary depending on one's metaphysical or scientific views. Getting clear on these various concepts, and on the conditions under which temporal error theory of any kind obtains will be especially important if there is interdisciplinary disagreement about whether there is time since such disagreement may be a matter of philosophers, physicists and metaphysicians talking past one another. For now, however, we focus on the folk concept of time. With that concept articulated we will see whether anything in the world satisfies the folk concept of time given various physical and metaphysical hypotheses about the world. That leaves it open what we should say about various metaphysical or physical concepts of time on these selfsame metaphysical and physical hypotheses. However, while it would be interesting to discover that an error theory about physical or metaphysical time is true it is not obvious that this would have the same ramifications for our ordinary ways of understanding ourselves and our role in the world, and it is primarily these ramifications in which we are interested.

The paper is partitioned as follows. We begin, in Sect. 2, with some preliminary observations about time before, in Sect. 3, outlining a folk concept of time that best explains these observations, a concept that can then be used to provide a precise statement of a number of different forms that a folk temporal error theory might take, i.e. error theory about our everyday discourse about time. In Sect. 4, we apply this conceptual framework to some actual cases, arguing that few extant timeless theories imply folk temporal error theory. This is important, as it suggests that these theories are far less radical than they might first seem. In Sect. 5 we sum up.

2 Relative ineliminability

The starting point for our investigation is an observation about the folk concept of time. Time, in the folk sense, is quite resistant to arguments for its elimination. Though both McTaggart (1908) and Gödel (1949) have argued for an error theory about time, their arguments have typically failed to convince. That there is

something in our world that is a good enough deserver to satisfy the concept of time typically seems more certain to us than any philosopher's argument to the contrary. There are relatively few things we could discover about our world that would lead us to conclude that there is no time, rather than to conclude that time is somewhat different to how we had supposed. Call this phenomenon *relative ineliminability*.

To be clear, the claim that time is relatively ineliminable is to be understood as a claim exclusively about the folk notion of time. We hold to temporal realism *with respect to that concept* so tenaciously that we reject the conclusion of arguments against the reality of time without knowing which features are essential to time so construed, and thus without knowing what the necessary and sufficient conditions for satisfying the folk concept are. This is particularly striking with respect to McTaggart's argument. While many accept that the argument shows there is, necessarily, no temporal flow, few who accept *that* also accept that the argument shows that there is no time; concluding, instead, that temporal flow is not essential to the existence of time in the folk sense. This is striking because the argument is aimed directly at the reality of time itself and yet that part of the argument has never been taken very seriously. There is, perhaps, a metaphysical concept of time that is shown not be satisfied if McTaggart's argument succeeds: a certain metaphysical temporal error theory is vindicated. But folk temporal theory is not and that's the important point.

The relative ineliminability of time appears to be a corollary of two related and widely held beliefs. First, we typically give high credence to the existence of phenomena that appear, of necessity, to require the existence of time, namely causation, persistence and change. We also give high credence to the existence of certain agential phenomena that appear to require these 'timeful' phenomena. We believe it is rational to plan for the future, and morally justifiable to hold agents responsible for acts performed in the past. We give high credence to the existence of these timeful phenomena in part because they are central to an understanding of ourselves as agents: in order to be agents who are (a) morally accountable and (b) capable of reasoning prudentially, we must (i) persist through time, (ii) be causally efficacious and thus (iii) capable of instituting change in the world. Because we believe that we are such agents, we believe in the existence of (i)–(iii), and because the existence of (i)–(iii) require time it is very difficult to accept temporal error theory. In short, folk temporal error theory is deeply hostile to our standard conception of agency.

The second reason why time is relatively ineliminable is that it is central to our phenomenology: it *seems* to us that we acted at moments previous to this one; we *seem* to have memories of the past; it *seems* to us that what we did in the past causally affected the way things are now; it *seems* to us that the decisions we make now will affect our future but not, in general, our past, and so on. Moreover (and perhaps more controversially) it seems to us, in experience, that some events are earlier than, later than or simultaneous with others and (even more controversially) it seems to us as though time flows.[2] It is, therefore, difficult to accept that time does

[2] We set aside the debate about how best to explain the experience of temporal passage. For recent discussion of this issue, see Paul (2010), Prosser (2007) and Skow (2011).

not exist because, arguably, the best explanation for our temporal phenomenology seems to be that time exists and is responsible for the way we experience the world. Indeed, it may be that time does not just explain why we experience what we do: whatever we are experiencing via what we call temporal phenomenology, that thing (within bounds) *just is* time.[3]

3 The concept of time

What does relative ineliminability teach us about the folk concept of time? One plausible answer, suggested by Bourne (2006, pp. 220–222; *a lá* Lewis (1970), is that the folk concept of time is a theoretical concept: so long as something realises the role that the folk take time to play, then 'time' as it used in the folk discourse, refers. This makes good sense of how we, the folk, can be justified in rejecting the conclusion of a McTaggart-style argument without having a grasp on time's essential features. Even if we don't know exactly what time in the folk sense *is* we know what time so construed *does*: namely, it supports certain timeful phenomena (i.e., causation, persistence and change) and explains our temporal phenomenology. Because we know (or at least think we know) that this work is being done actually, we give high credence to the claim that the folk concept of time is satisfied and thus that time in the folk sense exists.

Let us call whatever it is that satisfies the folk concept of time, time_{F}. Let us also call the set of objects, properties or relations that jointly realise the time_{F} role in a world, *w*, *F*. Then if time_{F} exists in *w,* in *w* time_{F} is constituted by, or grounded in, or supervenes on, *F*. What exactly is the time_{F} role? Well, whatever plays the time_{F} role must be something in virtue of which we have certain kinds of phenomenology that we do: namely, the kinds of phenomenology that we *call* temporal. If actually there is no time_{F}, then the phenomenology we have is, arguably, not temporal phenomenology. For simplicity however, we use the locution "temporal phenomenology" to pick out phenomenology that is relevantly like the kind of phenomenology that we actually pick out by our use of the term "temporal", whether our actual phenomenology tracks temporal relations or not. Thus this includes (at a minimum) the phenomenology described so far, namely: experiences as of temporal duration, temporal distance, and temporal ordering.

Let us suppose that our temporal phenomenology is grounded in our cognitive architecture, which, in turn, is grounded in our brain states. In general we will say that whatever it is in virtue of which we have the temporal phenomenology we do grounds our temporal phenomenology. But we also suppose that our brain states are responsive to states of the world. Our cognitive states represent that the world is a certain way, and in most cases we assume that the world is, roughly, that way. We assume that our temporal phenomenology *tracks* something in the world, and that what is tracked is time_{F}. It is not our task to offer an account of veridical, as opposed to non-veridical representation. We will, however, offer the following rough

[3] See Healey (2002, pp. 299–300) for a further argument for the relative ineliminability of time.

characterisation of what we have in mind. Let us say that a representational state, *S*, with content, *C*, *tracks* a kind of phenomenon, *P*, in the world, if tokenings of *S* are reliably correlated with tokens of *P* [e.g. *S* tracks tokens of *P* if (but not only if) *P* causes tokens of *S*]. Let us say that a representational state, *S*, with content, *C*, *successfully* tracks a kind of phenomenon, *P*, in the world, if tokenings of *S* are reliably correlated with tokens of *P*, *and* content, *C*, is a representation of *P*. In essence, tokens of *S* successfully track *P* if the world is as *S* represents it to be, and *S* represents it to be such that *P* obtains. Under this way of construing the relevant notion of tracking, if our temporal phenomenology successfully tracks some phenomenon, then that phenomenon just is time_F (as suggested above).

Suppose that actually our world contains a single instant (or a single three-dimensional object, if you prefer). Then there is *nothing* that our temporal phenomenology tracks (successfully or not) because, in such a world, there is no temporal duration, temporal distance or temporal ordering. All that exists is a single, spatial configuration. But while there is nothing that our temporal phenomenology tracks, there may well be something that *grounds* that phenomenology: namely a three-dimensional complex representational brain structure that exists in that instant.[4] Thus, unsurprisingly, that our phenomenology is grounded by something is consistent with us failing to track anything at all, and hence with there being no time_F. Or suppose we live in a world in which there is time_F, but our temporal phenomenology is generated entirely by an evil demon. Our cognitive states ground our phenomenology, and that phenomenology tracks something, but the thing that it tracks is an evil demon, or perhaps some phenomenon created by that demon. In this case, though our phenomenology tracks something, the thing it tracks is not time_F.

So not just *anything* that our phenomenology tracks is a good candidate to count as time_F and just because our phenomenology is grounded does not mean it tracks anything. What plays the time role must be such that not only is it the thing that is tracked by our temporal phenomenology, but it has certain other minimal features that rule out evil demon worlds and the like. Exactly what these minimal features are is likely to be a thorny issue, precisely because we do not know what time_F's essential features are.[5] Nonetheless, we can say with some confidence that whatever plays the time_F role must (at least) be capable of supporting timeful phenomena such as change, causation and persistence. This places some constraints on the space of minimal features at issue.

In order to adequately support the timeful phenomena just mentioned, time_F should be capable of doing (at least) four further things. It should be capable of: (i) rendering sensible an indexical notion of 'now', (ii) supporting a difference between the past and the future, (iii) underscoring the manner in which the world displays a past/future asymmetry and (iv) scaffolding the asymmetry of

[4] Barbour (1999) argues that instantaneous brain structures can ground our temporal phenomenology in 'slice' worlds of this kind. The view is further developed by Ismael (2002) for ordinary, four-dimensional 'eternalist' worlds.

[5] The sorts of minimal features that one might countenance here include both logical and mathematical properties such as metricity, linearity and connectedness, as well as physical properties such as the nature of the laws and the distribution of matters of fact.

counterfactual dependence. To show this, we will briefly run through just one of the timeful phenomena considered above: agency. Similar considerations easily generalise to causation, persistence and change, however.

First, the concept of agency clearly requires indexicality. In order to be able to deliberate, one needs to know *de se* facts about where one is in relation to events. If one knows everything there is to know, but does not know where one is located in relation to events, one will not be able to make reasonable decisions about how to act. Agency also presupposes that there is a sensible difference between the past and future. This is not to say that it requires anything like an A-series. Rather, what it requires (at a minimum) is the idea that agents can take certain events to be fixed whilst taking others to be open, the latter constituting genuine options between which agents can deliberate. So anything that plays the time_F role and that allows for agency will be something that permits that difference (even if the difference is only one given by contingent facts about the distribution of features such as entropy).[6] The very same considerations apply to the past/future asymmetry. When choosing, we act towards (what we take to be) the future, and not toward the past. Whether this is because there is a temporal ordering that itself is anisotropic, or is due to the distribution of things within an isotropic ordering, we can expect any adequate characterisation of the folk notion of time to be one capable of supporting the asymmetry of agency and thus capable of accommodating at least the appearance of a past/future asymmetry. Finally: the asymmetry of counterfactual dependence. If the asymmetry of causation is to be understood counterfactually, and causation is also essential to agency, then it is clear that recovering the asymmetry of counterfactual dependence will be a crucial part of supporting agentive notions. Even if the asymmetry of causation is not to be analysed in terms of the asymmetry of counterfactual dependence, however, the asymmetry of counterfactuals remains important. For agency requires that we be able to make sense of what would happen in the future, were we to make certain choices; but not so for what would happen in the past, which calls on the very asymmetry at issue.

To be clear, our claim is not that, for instance, indexicality and temporal anisotropy enter into the analysis of our folk concept directly by being specified as part of the role of time. The point is that these phenomena enter into the analysis indirectly, because they are essential to the notions of agency, persistence and change, which *are* appealed to directly in specifying the role of time in our folk concept. Consider, then, the set of worlds, W, in which something plays the time_F role, and the complement class of W, W^*, in which nothing plays the time_F role. Every world in which there is causation, persistence or change is a world located in W. Having the time role played at a world is a necessary, but not sufficient, condition for the existence of change, causation and persistence. Thus, roughly, a set of objects, properties and relations, F, jointly plays the time_F role just in case F is tracked by our temporal phenomenology and F has certain minimal features, including features that are necessary for the existence of change, causation and persistence, where what it is to support timeful phenomena is, in part, to support

[6] As for instance, Price (1997) holds.

indexicality, directionality, asymmetric counterfactuals and so on. This second condition rules out that an evil demon counts as being time_F even if the demon is what is tracked by our temporal phenomenology, because (at a minimum) evil demons are not necessary for the existence of timeful phenomena.

Here is the proposal. If time_F is whatever plays the time_F role, then the folk concept of time can be stated as follows:

> (C1): Time_F is whatever it is, *R*, that is being tracked by our temporal phenomenology such that *R* possesses certain minimal features, *F*, where *F* includes features that are necessary for the existence of causation, persistence and change.

Given (C1), the scope for thinking that time_F does not exist actually—what we call the 'A-scope' of folk temporal error theory—depends on what sorts of features *R* (the phenomenon that is tracked by our temporal phenomenology) must possess, in order to count as being time. This, in turn, depends on (a) what sorts of features are necessary for causation, persistence and change and (b) what sorts of additional features one might take to be necessary in order for *R* to count as being time_F. If *R* must possess a great many features to satisfy (C1), then actual temporal error theory is a plausible epistemic possibility since there are more ways for things to 'go wrong'; there are a number of conditions that the actual world must meet in order for it to be one in which there is time_F, and the failure of any one of these would vindicate some form of folk temporal error theory. Similarly, if *R* must possess a range of metaphysically contentious features in order to play the time_F role, then one may have good grounds for endorsing temporal error theory since one might doubt that these features obtain. Because the A-scope of (C1) is sensitive to what it takes to satisfy the time_F role, (C1) allows us to model the relative ineliminability of time: what it means to say that time is relatively ineliminable, is that the A-scope of (C1) is *narrow*; the minimal features that *R* must possess in order to count as being time are *very minimal* indeed.

So far so good; time is, actually, whatever is tracked by our temporal phenomenology so long as whatever is tracked possesses certain minimal features (whatever those might be). But now we want to say something about time_F in counterfactual worlds. Suppose that judgements about whether a world is one in which there is time are sensitive to which world one supposes to be actual. For example, suppose that, at *t*, one gives high credence to the actual world containing time_F in virtue of the actual world possessing temporal flow. Then one might hold that all and only worlds with temporal flow contain time_F. Suppose, however, that at $t+$ one comes to believe that the actual world lacks temporal flow. All that exists is a linear, asymmetric ordering of instants: the B-series. Suppose one does not conclude that actually there is no time_F, but instead, comes to hold that actually time_F is B-theoretic and that any world with a B-series has time_F regardless of whether it has temporal flow. One's changed views about the nature of the actual world have changed one's views about the extension of "time_F" counterfactually. If one's counterfactual judgements about the extension of a term "T" are sensitive to which metaphysical features one takes the actual world to have in this way, one's modal judgements about the extension of "T" are *actual world sensitive*.

If judgments about time_F are actual world sensitive, then the folk concept of time is rigid: it tracks, across all possible worlds, whatever it is actually that realises the time_F role. This suggests the following:

> (C2): Necessarily, time_F is whatever it is, *R*, that is tracked by our actual temporal phenomenology such that *R* possesses certain minimal features, *F*, which include features that are necessary for the existence of causation, persistence and change.

Alternatively, if judgements about time_F are not actual world sensitive, then a non-rigidified concept of time_F, such as the following, will be more appropriate:

> (C3): For any world *w*, time_F in *w* is whatever it is, *R*, that is tracked by temporal phenomenology in *w*, if there is any, so long as *R* has certain minimal features, *F*, that include features that are necessary for the existence of causation, persistence and change, or if there is no temporal phenomenology in *w,* time_F is whatever it is that has certain minimal features, *F*, that include features that are necessary for the existence of causation, persistence and change.

For worlds in which there is no temporal phenomenology, (C3) places heavy weight on the relevant minimal features that must obtain in worlds if there is to be time_F in those worlds. This emphasises the need to provide an account of these features. That is a project in itself and largely orthogonal to the more abstract questions about folk temporal error theory at issue. Hence we wish to remain largely neutral about what sorts of properties and relations to include in these minimal constraints.

The choice between (C2) and (C3) has implications for the 'C-scope' of folk temporal error theory: the scope for thinking that there are counterfactual worlds without time_F. Suppose one endorses (C2). One thinks that time_F is, necessarily, whatever it is that actually plays the time_F role. Then folk temporal error theory will be true in any counterfactual world, *w,* just in case either (i) there is no time_F actually: nothing actually plays the time_F role or (ii) whatever it is, *R*, that actually plays the time_F role does not exist (occur or obtain) in *w*. Call these the counterfactual error theoretic conditions (CETC) relative to (C2). Thus:

> **CETC (C2):** For any counterfactual world, *w, w* lacks time_F just in case either (i) there is no time_F actually: nothing actually plays the time_F role or (ii) whatever it is, *R*, that actually plays the time_F role does not exist (occur or obtain) in *w*.

Given CETC (C2), the C-scope of folk temporal error theory depends on the nature of the actual world. So, for example, suppose the A-series—a dynamic ordering of instants in terms of pastness, presentness and futurity—plays the time_F role actually: then all and only worlds with an A-series possess time_F. Any counterfactual world that lacks an A-series is a timeless world, even if that world possesses a B-series, (if possessing a B-series without an A-series is possible) and even if the B-series is (i) what is tracked by the temporal phenomenology of agents in that world and (ii) necessary for the existence of causation, persistence and change.

If (C3) is the correct concept of $time_F$ then folk temporal error theory will be true in any counterfactual world, *w,* just in case nothing plays the $time_F$ role in *w*. More specifically, the counterfactual error theoretic conditions for (C3) are as follows:

> **CETC (C3)**: For any counterfactual world, *w, w* lacks $time_F$ just in case either (i) there is temporal phenomenology in *w*, but whatever is tracked by that phenomenology does not have the minimal features required for $time_F$ (i.e., it is not necessary for causation, persistence and change or it fails to meet some other minimal requirement) or (ii) there is no temporal phenomenology in *w,* and there is nothing in *w* that meets the relevant minimal requirements for $time_F$.

Without knowing exactly what it would take at each world for the $time_F$ role to be played, it is difficult to pinpoint the C-scope of (C3). The conceptual requirements placed on $time_F$ by (C3) are minimal. But it is consistent with our concept being minimal in this way that the features necessary for causation, persistence and change are nevertheless metaphysically complex features not shared by most worlds. Indeed, it is consistent with (C3) that only worlds with an A-series turn out to be worlds with $time_F$.

As we shall see, in addition to modifying the C-scope of folk temporal error theory, (C2) and (C3) lead to different forms of folk temporal error theory. We think these are competitors to be the correct folk concept of time so in what follows we outline each version of folk temporal error theory. In doing so it is important to distinguish two questions: what would it take for folk temporal error theory to be true in the actual world? And: what would it take for folk temporal error theory to be true at a counterfactual world? We will say that folk temporal error theory is true, actually, just in case there is nothing that actually plays the $time_F$ role. We call this hypothesis actual folk temporal error theory.

> **Actual Temporal Error Theory (AFTET)**: There is nothing that actually plays the $time_F$ role.

By contrast, if temporal error theory is true at a world, *w*, and *w* is not the actual world, then we will say that counterfactual folk temporal error theory is true:

> **Counterfactual Temporal Error Theory (CFTET)**: There is at least one counterfactual world in which nothing plays the $time_F$ role.

CFTET divides into two related versions of folk temporal error theory, depending on whether one adopts (C2) or (C3). If one endorses (C2), then a counterfactual world in which $time_F$ does not exist is a world in which what plays the $time_F$ role actually does not exist. If, by contrast, one endorses (C3) then a counterfactual world in which $time_F$ does not exist is a world in which nothing plays the $time_F$ role *in that world*. This leads to the following two versions of CFTET:

> **(C2)-(CFTET)**: There is at least one counterfactual world in which what plays the $time_F$ role actually does not exist.
>
> **(C3)-(CFTET)**: There is at least one counterfactual world in which nothing plays the $time_F$ role in that world.

4 Actual folk temporal error theory

Of the different versions of folk temporal error theory outlined arguably versions of AFTET are the most interesting. If some version of AFTET were to be vindicated then that would be a radical result indeed. Not only would it show that there is nothing satisfying our folk concept of time, but it would put into jeopardy the web of agentive and timeful beliefs previously mentioned—causation, persistence, change, prudence and so on—each of which seems to stand or fall with the satisfaction of our folk temporal concept. In this section, we will apply the conceptual machinery developed in the previous section to some views currently available that claim to offer a timeless picture of reality.

Note that proponents of these views might be saying two quite different things when they claim that time does not exist: (a) they might be saying that, given the folk concept of time, if the world is, metaphysically or physically, the way they argue it is, then we should be error theorists about the folk concept, thereby adopting AFTET or (b) they might be saying that if the world is the way they claim it to be, then given a metaphysical or physical conception of time that is *not* the folk conception, (and is not satisfied just when the folk concept is), then nothing satisfies the metaphysical or physical conception of time in question.

In truth, we are not sure which of (a) or (b) best describes the view of proponents of so-called timeless theories. For now, however, we are only going to consider (a). Our aim is to simply consider whether, on the assumption that a given supposedly timeless theory is correct about the metaphysics or physics of our world, we should adopt AFTET. In short, we are interested in the extent to which current timeless theories leave enough structure in reality to allow us to say that the time_{F} role is being played, and thus that the folk concept of time is satisfied. This accords with our previously stated interest in the implications of current timeless physical and metaphysical theories for the status of our folk discourse about time.

It is important to note that the views we consider here are quite technical. Hence, in what follows we try as far as possible to abstract away from the technical details, focusing instead, in each case, on the metaphysical upshot. Note also that our aim is not to be exhaustive in our application of the foregoing conceptual framework. Our goal, rather, is to show how to apply the framework by looking at three interesting cases.

4.1 Tallant

Tallant (2008) argues that eternalism is best thought of as a view according to which time does not exist. Eternalists typically deny the reality of the A-series, committing only to the existence of the B-series. Tallant's thought, very roughly, is that all of the work that the B-series can do for the eternalist, can be done by dividing the world into three-dimensional slices (what Barbour 1999 calls relative configurations, see Sect. 5.3) and subsequently ordering the three-dimensional slices that exist in the actual world via an entropic C-series: a non-B-theoretic ordering based only on entropy. Hence, B-relations (and thus the B-series) are an ontological extravagance. Since, all things considered, a simpler ontology is preferable, we

ought to reject the existence of the B-series. Therefore, the best version of eternalism[7] is one that denies the reality of the B-series and thus, according to Tallant, the reality of time.

The crux of Tallant's argument is that an entropic ordering can do everything that the B-series can do. In defending this claim, Tallant appears to be committed to three things. First, that there is counterfactual dependence between events in the entropic ordering, and thus that causations exists along the entropic C-series (Tallant 2008, pp. 119–120). Second, that change and persistence exist along the entropic C-series (Tallant 2008, pp. 122–123). Third, that the entropy gradient underlies our temporal phenomenology (Tallant 2008, p. 122). Although Tallant does not spell out this last point in detail, it seems reasonable to develop the thought as follows. Our temporal phenomenology tracks the entropy gradient in that experiences of temporal distance, duration and ordering (and, possibly, flow) are reliably correlated with the gradient of entropy from lower to higher entropy. For instance, tokenings of representations of the form 'time t is earlier than time $t+$' are reliably correlated with entropy relations of the form 'three-dimensional slice s has lower entropy than slice $s+$' and representations of the form 'time t is later than time $t-$' are reliably correlated with entropy relations of the form 'three-dimensional slice s has greater entropy than slice $s-$' and so on.

Whether or not this is exactly what Tallant had in mind is hard to say. However, it is important for Tallant's argument that something along these lines is correct. For if our temporal phenomenology does not track the entropic C-series but, rather, tracks the B-series, then there is a phenomenological argument from the nature of experience to the existence of the B-series available, an argument that would cut against Tallant's own case for timelessness. Tallant is, however, understandably pessimistic about the existence of a phenomenological argument of this kind, and so we can assume that he means for the entropic C-series to be doing the relevant work in supporting our temporal phenomenology. Now, to be clear: our claim is not that Tallant has provided us with a full story about how the entropic C-series can support the everyday temporal phenomenology that underlies the folk concept of time. Rather, our point is that Tallant is subject to a dilemma. Either the entropic C-series *cannot* support the every temporal phenomenology that underlies the folk concept of time, in which case Tallant's own argument in favour of metaphysical timelessness fails to go through, or the entropic C-series can support the very temporal phenomenology that underlies the folk concept of time, in which case although the argument goes through, it does not establish that we should be error theorist bout the folk concept of time. It might, of course, establish that we should be error theorists about some other concept of time.

Given the concept of time outlined here, namely (C1), the three claims that constitute the basis of Tallant's argument show quite clearly that it does not vindicate AFTET. As we have seen, (C1) has two parts: time_F is whatever is (i) tracked by our temporal phenomenology and (ii) has certain minimal features necessary for causation, persistence and change. Because, on Tallant's view, it is the

[7] For a discussion of how to characterize eternalism, see Baron and Miller (2013).

entropic C-series that is tracked by our temporal phenomenology and because causation, persistence and change all exist along the entropic C-series, it follows that the entropic C-series possesses the minimal features necessary for the existence of such phenomena. Thus, the two parts of the concept (C1) are satisfied by the entropic C-series and so something is playing the time_F role in the version of eternalism that Tallant outlines. His conclusion, then, that time does not exist because the B-series does not exist, and thus that eternalism is a version of temporal error theory, should not be interpreted as the claim that eternalism is a version of folk temporal error theory. Rather, time in the folk sense exists in what Tallant takes to be the actual world; it just fails to be B-theoretic.

4.2 Rovelli

So the first timeless theory fails to support a folk temporal error theory. This brings us to the second timeless picture, developed by Rovelli. It is well known that there are difficulties in weaving together the theory of general relativity, on the one hand, and the various theories in quantum mechanics, on the other hand, to produce a theory of quantum gravity. To address this difficulty, Rovelli (1991, 2004, 2007, 2009) recommends a theory of quantum gravity that aims to take seriously the lessons about time learned from general relativity and apply them to the quantum context (for a similar view, see Deutsch 1997).

Healey (2002, pp. 305–306) classifies Rovelli's view as a version of *timeless* Parmenideanism. The timeless Parmenidean believes, on the one hand, that there is no change and, on the other hand, that there is no time. Timeless Parmenideanism is to be contrasted with changeless Parmenideanism, which denies the existence of change only (see, for discussion, Earman 2002). There are two ways to develop timeless Parmenideanism. First, one might interpret it as the claim that there is no time_F, and thus as a version of folk temporal error theory. Second, timeless Parmenideanism might be interpreted as the claim that there is no time, according to some metaphysical or physical conception of time, whilst remaining silent on the status of time_F and thus remaining neutral on the status of folk temporal error theory. It is unclear which version of timeless Parmenideanism Healey has in mind. As we shall now argue, however, if Healey's claim is that Rovelli defends a version of the first kind of timeless Parmenideanism (the one pertaining to folk temporal error theory), then it is not obvious that his classification is correct. For when Rovelli says that time does not exist he really means that time does not exist *fundamentally*:

> The physical hypothesis that we put forward is the absence of a well-developed concept of time at the fundamental level… We suggest that at the Planck scale dynamical systems cannot be described as evolving in a universal time quantity t. (Rovelli 1991, p. 442).

Importantly, by "quantity t", Rovelli (1991, p 443) has in mind the "time of Newtonian, Hamiltonian, or quantum mechanics". Moreover, he takes quantity t to be that which our experience of temporal flow tracks. What Rovelli seems to be suggesting is that fundamentally there is no *A-series*, since for many that is the

natural way to spell out the feature of time that is tracked by the experience of flow, and it is the natural way to understand Newton's 'absolute time'.

If that is right, however, then Rovelli's is not a version of folk temporal error theory. At best, the view is a version of the B-theory. In the end, however, what Rovelli really means is that—fundamentally—there is no A-series *and there is no B-series either*. Still, as we have just seen, the fact that the B-series does not exist is not yet enough to show that there is no such thing as time_F, since—as Tallant shows—an entropic C-series is capable of playing the time_F role. Nevertheless, let us suppose for the sake of argument that, fundamentally, nothing plays the time_F role in Rovelli's theory of quantum gravity and thus, fundamentally, time_F does not exist.

Even if this point is conceded, Rovelli's view still fails to be genuinely error theoretic with respect to the folk concept of time. For as Rovelli (2009, pp. 7–9) makes clear, although nothing plays the time_F role fundamentally, there is nevertheless something that satisfies the folk concept of time. Indeed, Rovelli's pronouncements on this matter are very similar in spirit to Tallant's own views about entropy, though not in letter. For Rovelli, time_F arises at non-fundamental levels and is thermodynamical in origin. The basic idea is that the features that we commonly attribute to time, those things that (on our view) are partly constitutive of the time_F role, really belong to the statistical distribution of macroscopic properties across physical systems. Rovelli calls this statistical distribution 'thermal time' and shows that thermal time can do much of the same work as Newton's absolute time. If Rovelli's thermal time hypothesis is correct, however, then we have good reason to resist the idea that his view is a version of folk temporal error theory: the time_F role is being played, it is just not being played by the B-series.

Rovelli might respond as follows. Thermal time, along with the statistical distribution of macroscopic properties upon which it rests, is not part of the "fundamental mechanical structure of reality" (Rovelli 2009, p. 8). But time_F exists only if it exists fundamentally. So even though *something* plays the time_F role, nothing plays it fundamentally and whether or not the time_F role is filled fundamentally is what matters. This response is open because our analysis of the folk concept of time is insensitive to the distinction between the fundamental and the non-fundamental. Explicating the concept in this fashion was, however, deliberate. We think the folk concept of time really is insensitive to this distinction, at least when it comes to ontology. As long as *something* plays the time_F role, whether it is fundamental or not, then that is enough to refute folk temporal error theory.

The considerations that support this are familiar. It is often the case that the entities which we take to exist at an everyday level do not, in the end, make an appearance in fundamental physics and so are not properly thought of as ontologically fundamental. To take a mundane example: we all believe in the existence of chairs. But there are no chairs in fundamental physics. Does that mean one should therefore endorse a folk error theory about chairs? It does not. The mere fact that an entity is non-fundamental according to our best science does not constitute grounds for ejecting that entity from folk ontology.

Rovelli's view, then, is not to be construed as a version of the first kind of timeless Parmenideanism and thus it is not a version of folk temporal error theory. It is not, we think, even plausible to think of the view as a version of changeless Parmenideanism about some folk notion of change since, for Rovelli, dynamical evolution and thus change can be recovered at non-fundamental levels. It is just that dynamical evolution can "only be defined with respect to physical clock variables" (Rovelli 1991, p. 441) which, in Rovelli's (2009) later work, is cashed out in terms of thermal time.

4.3 Barbour

Thus, two of the three putative cases of temporal error theory on offer fail to be versions of folk temporal error theory. We turn now to Barbour's (1994a, 1994b, 1999; Barbour and Isham 1999) Machian interpretation of canonical quantum gravity, which, like Rovelli's view, is an attempt to weave together general relativity and quantum theory. Barbour's view makes extensive use of a relative configuration space. Configuration spaces can be used to represent the state of an entire system as a point in a higher-dimensional space. A relative configuration is a specification of all the inter-particle distances at some 'instant'.[8] Barbour deploys a relative configuration space that represents entire three-dimensional, relative configurations of the universe. Specifically, Barbour's configuration space includes *all physically possible* three-dimensional configurations of the universe. On one way of reading Barbour's theory of quantum gravity, the actual world—our universe—corresponds to a single *point* in this relative configuration space (RCS). Importantly, this single point is not connected to any other points in RCS via some objective ordering, such as the B-series or even the entropic C-series. Indeed, each point is completely isolated in this respect.

According to Butterfield (2002), Barbour's theory of quantum gravity can be usefully thought of as a combination of presentism and modal realism. Presentism is (roughly) the view according to which only present entities exist, where the present is taken to be a single instant of time. Modal realism, by contrast, is the view according to which there are other concrete possible worlds that, like the actual world, exist; worlds that are not connected to the actual world in any substantive way. At first blush, this diagnosis of Barbour's view appears apt: on Barbour's view, the actual world corresponds to a single three-dimensional configuration and so in this way it is akin to presentism; but it is also akin to modal realism in that all physically possible configurations exist.

As Butterfield cautions, however, we must be careful in treating Barbour's view as a version of presentist modal realism, for two reasons. First, under presentism, it is typically thought that the past *existed* and the future will exist, and thus that which instant is present changes as time passes (Fiocco 2007; Tallant 2009). The points in Barbour's configuration space are, however, static: there is no sense in which the

[8] Specifically: A relative configuration is a specification of all the inter-particle distances (and so of all the angles) at some instant, without regard to (a) where the system as a whole is in absolute space, nor to (b) how it is oriented, nor to (c) its handedness. (Butterfield (2002, p. 303))

configuration that exists actually will change to a different configuration. Each point in RCS exhausts the ontology of its own little universe: all that exists, existed and will ever exist from the perspective of a point is the same, three-dimensional configuration. Second, under Lewis's (2001) full-blown modal realism, all *logically possible* worlds exist, where each world is a four-dimensional space–time. However, under Barbour's view, the space of existing worlds includes only physically possible worlds, and each world is not a complete space–time as under Lewis's view.

It has been recently suggested that Barbour's view is a version of temporal error theory, because the actual world, on his view, lacks both an A-series and a B-series (cf. Baron et al. (2010)). But care is warranted here also since, as we have seen, lacking both an A-series and a B-series is not enough to guarantee the truth of a folk temporal error theory. In order to count as a version of folk temporal error theory it must be that nothing plays the time_{F} role in a Barbour universe. That is, there is nothing that our temporal phenomenology tracks and which possesses the minimal features necessary for persistence, causation and change. Now, Barbour accepts that in the actual world, there exist conscious beings and so he accepts that our phenomenology remains intact even though time does not exist. It is just that, on Barbour's view, our phenomenology is massively misleading: we experience motion and change even though there is none; we experience temporal flow, even though there is no such thing; and we remember the past, even though there never was a past.

Thus, for Barbour, our temporal phenomenology does not track anything that is a candidate to be time_{F}. The only thing that our temporal phenomenology could track is, according to Barbour, a time capsule—a time capsule is a three-dimensional configuration which contains a nested structure of three-dimensional representations of other points in RCS; representations which make it seem *as if* the world had a history and thus make it seem as if there is time_{F}. But these three-dimensional configurations lack the minimal features necessary for (at least) persistence and change.[9] This is so for the following reason: according to Barbour, persistence and change cannot exist at a three-dimensional point in RCS. So every world in which persistence and change exist, is *not* also a three-dimensional point in RCS. But if every world in which persistence and change exist is not also a point in RCS, then it follows that such points are not necessary for the aforementioned timeful phenomena.

Thus apparently, on Barbour's view, the actual world is one in which AFTET is true, since nothing plays the time_{F} role actually. Now, it might turn out that Barbour is not a genuine error theorist about the folk notion of time if, like Rovelli, time_{F} is recoverable at some non-fundamental level. If, for example, a temporal ordering could be recovered from the fundamental configuration space of three-dimensional relative configurations, then that might be a reason to think that there is something playing the time_{F} role actually. One reason for thinking that Barbour and Rovelli

[9] There is reason to think that three-dimensional configurations lack the minimal features for causation as well, though see Baron and Miller (2014) for an attempt to make sense of causation in the context of Barbour's view.

come together on this point is that Barbour's Machian reformulation of general relativity does allow for the recovery of a B-series at non-fundamental levels. However, Barbour's Machian general relativity is superseded by his interpretation of canonical quantum gravity and it is clear in his account of quantum gravity that the B-series is not recoverable (see, for discussion, Baron et al. 2010; Anderson 2006, 2009, 2012a, 2012b). At best, one can 'paint' world-histories onto the configuration space, by looking at the 'information' encoded in a time-capsule, using this to cobble together an account of the past. But these 'painted on' world histories have, for Barbour, no physical significance: they are part of our representations of the universe, representations that are ultimately misleading. So Barbour and Rovelli part ways. For Barbour, time_{F} is not recoverable at non-fundamental levels, and it is partly for this reason that his view is an instance of AFTET.

5 Conclusion

Some physicists and metaphysicians deny the existence of time. This paper can be thought of as an attempt to understand what these denials amount to. We have articulated a conceptual framework within which to determine whether or not a view is genuinely error theoretic about the folk notion of time. We applied this framework to three views currently on offer that claim to deny the existence of time. We argued that only one of these counts as a genuine version of folk temporal error theory. This fits with our initial observation about the relative ineliminability of the folk notion of time, namely that there is very little one could discover about the actual world that would lead one to endorse AFTET. Conversely, we now have a sense of what it would take for AFTET to be vindicated: if Barbour's interpretation of canonical quantum gravity were vindicated, then that would be grounds for thinking that the folk concept of time is not satisfied actually. His is a genuinely timeless theory.

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