Abstract: I explore a common-sense view of time’s passage, namely: what it is for time to pass is for particular amounts of time to pass between pairs of times. It is a fundamental fact that: four hours passed from 8am today until noon (assuming that time’s passing is a fundamental aspect of reality). First I clear up puzzlement about the rate of time’s passage. Time passes at lots of rates; but given that the fundamental facts about passage all take the proposed form, none of those rates metaphysically illuminates what it is for time to pass. Second, I show that an A-theory of time can happily adopt this view of passage. The resulting package rejects some orthodox metaphysical assumptions, yet it attractively articulates our pre-relativistic conception of time.

Keywords: passage of time, rate of passage, A-theory of time, metaphysics.

1. Introduction
It is a platitude that time passes; yet it can also seem philosophically mysterious. It helps to see that ‘time passes’ is a generic claim, to be understood in terms of its instances. Time passes because particular periods of time pass. On the view we will explore, what it is for time to pass is for specific amounts of time to pass between pairs of times. The official ideology for talking about passage is: amount of time $t$ passed from time $T_1$ until time $T_2$. The fundamental facts about passage take this form, says the proposal. For example: four hours passed from 8am today until noon. Together with the facts that I breakfasted at
8am and luncheoned at noon, this explains why four hours passed from my breakfasting until my luncheoning. (I used a particular system of units and time of origin to state this example, but that’s not essential for naming times and amounts of time.) I prefer to say that fundamentally, time passes between pairs of times, rather than pairs of events, because time could pass even if nothing ever happens. I take the proposed ideology to be utterly familiar: office workers everywhere agree that 8 hours passed from 9am to 5pm last Tuesday. Don’t complain that the proposal doesn’t really explain how time passes: the passage of time is too fundamental to be explained in other terms.

I will defend the proposal from a priori objections, and show it is happily combined with an A-theory of time in a pre-relativistic setting. However, I believe that Special and General Relativity refute the proposal as stated. Maybe we can adapt it to a relativistic setting as follows. What it is for time to pass is for specific amounts of time to pass between points *along timelike curves*. That is, periods of ‘proper time’ pass, and that’s good enough.¹ I explore this relativized proposal elsewhere (Author MS); here I focus on refuting armchair objections to the unrelativized version.

I’ll start by clearing up puzzlement about the rate at which time passes, thereby removing a reason for thinking that time doesn’t pass at all (§2). Then I’ll rebut the accusation that the proposed view of passage is too deflationary to be adopted by an A-theory of time. In my view, the proposal is compatible with both A-theories and B-theories (§3). However, the proposed view of passage is not compatible with certain

¹ Savitt (2009) defends such a view of passage. He assumes it is only compatible with a B-theory of time, which I deny (MS). Other relativistic views of passage are formulated by Dieks (2006), Dorato (2006), Maudlin (2007), and Pooley (2013).
commitments that have unnecessarily become associated with A-theories. I pooh-pooh the relevant orthodoxies in §§4–6. These sections articulate an unorthodox, unexamined, yet attractive A-theory.

2. At what rate does time pass?

Some philosophers argue that time doesn’t pass, for if it did, it would have to pass at some rate, for which there is no sensible candidate.²

I’ll defend the view that time passes at all sorts of rates. It always passes at 1 second per 9,192,631,770 periods of the radiation corresponding to the transition between the two hyperfine levels of the ground state of a cesium 133 atom at 0 kelvins.³ It also always passes at 1s per s. This morning, time passed at 1s per 10,000 litres flowing through my local dam’s turbine. It also passed at 20 minutes per paper I graded. This afternoon, it passed at 15 minutes per paper I graded (a small mercy for which I am thankful). However, none of these rates metaphysically illuminates how time passes. The metaphysically illuminating things to say about time’s passing are all of the form: amount of time t passed from time T₁ until time T₂. (§3 explains why A-theorists in particular need not say anything more about time’s passing.) Other theories of passage can give this kind of response to puzzlement about the rate of passage, but I’ll present the point using

² Philosophers who use considerations of rate to argue that time doesn’t pass include Donald Williams (1951), Jack Smart (1991), Eric Olson (2009), and Huw Price (2011). Jonathan Tallant (2013) surveys the recent literature. We’ll consider the recent debate in §2.4.

³ This is how the second is defined: http://physics.nist.gov/cuu/Units/second.html.
my preferred proposal. I will explain why I talk about claims ‘metaphysically illuminating’ a phenomenon, rather than using terminology familiar from the metaphysics literature.

Let’s start by looking at some examples that suggest we should generally be liberal about what rates there are. These examples are meant to soften you up, rather than establishing that time passes at all sorts of rates. Then I’ll actually argue for that conclusion.

2.1. Rates are ubiquitous: some suggestive examples

Some rates are rates with respect to the passing of time; call them ‘speeds’. Not all rates are speeds. For example, factory workers might be paid at a piece rate, such as 10c per widget. The boiling point of water decreases as elevation from sea level increases; the boiling point changes at a rate of -1°C per +294m. (van Cleve 2010: 149.) In chess, the king can only move at a rate of one square per turn. The bulk aisle at my local supermarket sells organic quinoa at $5 per lb—that’s the rate of exchange of money for that good. Oil changes should be performed on a Toyota Corolla at a rate of 1 oil change per 10,000 miles driven. A hydroelectric power station generates energy at a certain rate per litre of water that follows through the turbine. Smoking cigarettes increases the chance of getting lung cancer—but at what rate per cigarette? The upshot is that a rate of time’s passing need not automatically be a rate with respect to time, at least not simply because it is a rate.

To fully specify a question, it is not enough to say what we want to know the rate of; we also need to say with respect to what we want to know its rate. For example, the hydroelectric power station generates energy at a certain rate per second, and a certain rate per litre. I jog at all sorts of rates: miles per hour, miles per calorie burned, calories
burned per mile traveled, mm of shoe tread worn away per mile, and so on. Again, it doesn’t completely specify a question to ask at what rate Mercury completes orbits of the sun. One might usefully answer: Mercury orbits the sun at a rate of 2 solar orbits per 1 rotation of that planet on its axis. (That is, one Hermian year lasts half a Hermian day.) So it is one thing to ask at what rate Mercury completes orbits of the sun with respect to rotations of that planet; it is another to ask at what rate it completes orbits of the sun with respect to the passing of time. The upshot is that we haven’t completely specified a question if we ask, at what rate does time pass? There might well be different quantities with respect to which we can ask the rate of passage. We might well be able to ask at what rate time passes with respect to the period of a certain kind of radiation emitted by caesium 133, or with respect to my cycling a mile, or with respect to the passage of time itself.

Rates can be variable, rather than constant or habitual. Speeds are paradigmatic rates. Because of the traffic lights and other obstacles, I didn’t ride my bike to work at a constant speed this morning. I don’t always catch the same lights, so my speeds vary day by day. But for any moment in any particular day’s ride, I am cycling at some speed—some rate. The upshot is that variable rates of the passage of time are on the cards. Maybe at 9:48am time was passing at 0.2 seconds per metre I cycled, and at 9:51am time was passing at 0.3 seconds per metre I cycled.

2.2. Rates are ubiquitous because all derivatives are rates

The ubiquity of rates is confirmed by the following sufficient condition for the existence of a rate: any derivative of a continuous function is a rate of change. Whenever we have a
function \( f(x) \), and that function has a derivative \( f'(x) \), then \( f'(c) \) is the rate of change of \( f(x) \) with respect to change in \( x \), at point \( c \).

If the function \( f \) has an inverse \( f^{-1} \) (i.e. each element of the range is mapped to by exactly one element of the domain), and \( f \) has a derivative \( f' \), then \( f^{-1} \) is differentiable too except where \( f'(x)=0 \). Specifically, \( f^{-1'}(x) = 1/f'(x) \), except for being undefined where \( f'(x)=0 \). So if I am moving at a non-zero rate with respect to the passing of time, say a rate of 2 miles per hour, then time is passing at a certain rate with respect to my moving, say \( \frac{1}{2} \) hour per mile I move. There is such a rate of the passage of time because there is such a derivative, and derivatives are rates. In general, if we have a rate of change of quantity \( Q \) with respect to time, and that rate is not zero, then we also have a rate of the passing of time with respect to change in \( Q \). That is, non-zero speeds convert to rates of passage. Rates of passage will vary, when the corresponding speed varies: 0.2 seconds per metre I cycled at 9:48am, and then 0.3 seconds per metre I cycled at 9:51am. Rates of passage will be constant when the corresponding speed is: time always passes at a rate of 1 second per \( 9,192,631,770 \) periods of a certain kind of radiation emitted by caesium 133.

Moreover, \( f(x)=x \) is a perfectly good function, for which \( f'(x)=1 \) for all \( x \). We can compare the amount of time \( t \) that’s passed since \( T_0 \) with the amount of time that’s passed since \( T_0 \), always finding that when \( t \) has passed, \( t \) has passed. That is, \( f(t)=t \). The derivative of that function exists. So we should allow that the rate of time’s passage since \( T_0 \) with respect to time’s passage since \( T_0 \) is always 1s per \( s \).

### 2.3. No rate metaphysically illuminates the passing of time

How much time has passed can be compared to all sorts of other quantities, and to itself, yielding all sorts of rates for the passing of time. But none of these rates metaphysically
illuminates the passing of time, the nature of passage. What metaphysically illuminates the passing of time are claims stated using the proposed basic ideology: amount of time \( t \) passed from time \( T_1 \) until time \( T_2 \). For example, four hours passed from 8am today until noon. There’s nothing more to say that would metaphysically illuminate what it is for that period of time to pass, and in particular nothing about a rate of passage. Given that time’s passing is a metaphysically fundamental phenomenon, the facts that illuminate its nature will be fundamental. In Ted Sider’s terminology (2012), ‘the book of the world’ does not state a rate for the passage of time. We’ve written the part of the book of the world relevant to time’s passing once we’ve said how much time passes between each pair of times. (§3 argues that using tensed or tenseless ideology to describe the state of the universe at other times also illuminates time’s passing. The point remains that no rate of passage does so.)

Similarly, if we aim to metaphysically illuminate what it is for two objects to be spatially separated by 2m, we should not say that they are spatially separated at some rate. Maybe there is nothing more to say than: they are spatially separated by 2m. That’s so, even if there are rates at which spatial separation changes. Consider Newton’s law of gravitation, \( F = GmM/r^2 \) (where \( F \) is the gravitational force between the two relevant objects, \( m \) is the mass of one object and \( M \) the mass of the other, \( r \) is the distance between their centres of mass, and \( G \) is the gravitational constant). Then \( r = \sqrt{GmM/F} \), and so \( dr/dF = -\frac{1}{2} \frac{r}{\sqrt{GmM/F^3}} \). That is, the spatial separation \( r \) of two objects changes with respect to the gravitational force between them \( F \) at a rate of \(-\frac{1}{2} \frac{r}{\sqrt{GmM/F^3}} \) metres per newton. But that rate does not metaphysically illuminate how objects are spatially separated. Again, we can compare the distance between two objects to the distance between those two objects, always finding those distances equal. These comparisons are
encoded by a function f, for which f(d) = d for all d, and so f'(d) = 1. The spatial separation of objects changes with respect to change in their spatial separation at a rate of 1 m per m. But that rate does not metaphysically illuminate how objects are spatially separated.

I propose that time’s passage is metaphysically illuminated by claims like: four hours passed from 8am today until noon. But aren’t such facts trivially true, and thus unilluminating? No—only the use of a specific naming convention for times makes such facts appear trivial. Suppose instead that we introduce demonstratively the names ‘Tyler’ and ‘Tammy’ for two times. It doesn’t seem ‘trivial’ that four hours passed from Tyler until Tammy. It certainly isn’t a priori under that mode of presentation. On some views, it will be necessarily true (if true at all) that four hours passed from Tyler until Tammy.

For example, structuralism about times holds that the identity of a time is exhausted by its temporal relations to other times.\(^4\) Structuralism holds that the facts about the passing of specific periods of time are metaphysically necessary, and that they metaphysically illuminate the natures of the individual times concerned. So necessary truths can be metaphysically illuminating.

I’ve made claims about what “metaphysically illuminates” time’s passing.

Couldn’t I have used terminology that’s familiar from the metaphysics literature? Let me explain why I didn’t put things in terms of what’s fundamental, essential, or intrinsic.

Firstly, non-fundamental processes occur at rates, only some of which are metaphysically illuminating. Maybe my speed metaphysically illuminates how I moved from home to the office, but the rate of miles per road rage incident does not. So one could claim that the

\(^4\) Structuralism about spacetime points is defended by Esfeld & Lam (2008) and Schaffer (2009: 135–6).
rates of time’s passage do not metaphysically illuminate, even if one thought that time’s passage is not fundamental. Secondly, the rates of time’s passage are contingent (except 1s per s and suchlike). Thus they are not candidates for being part of the essence of time’s passing, nor part of what it is for time to pass. But the contingency of such rates does not show that they are metaphysically unilluminating. For example, a contingent speed might illuminate how some process occurs. So a particular rate can metaphysically illuminate a process without being part of its essence. Thirdly, metaphysically illuminating features need not be intrinsic. For example, the structuralist about times takes them to be metaphysically illuminated by their temporal relations to one another. In sum, the familiar notions seem different from a claim’s metaphysically illuminating a phenomenon. So it seems appropriate to use the new terminology to state the claim about rates of passage.

2.4. The recent debate about rates

Let’s see how the proposal fits into the recent debate about the rate of passage. The standard argument is that time doesn’t pass, for if it did, it would have to pass at some rate, for which there is no coherent candidate. Tim Maudlin (2007: 111–4), Ian Phillips (2009), and James Van Cleve (2011: 162–4) reply that time does pass at a coherent rate, namely one second per second. But Huw Price and Jonathan Tallant object on the following grounds.

The problem [with the alleged rate of 1s per s] is not that these amounts of time are necessarily, a priori, of equal length. The problem is that they are the very same thing. … [Similarly,] we cannot sensibly inform [travelers] of how
many miles they will encounter per mile. (Price 2011: 303–4)

One might well think that, ‘a rate is a ratio of two quantities’…. In the temporal case, we do not have a second second – so to speak – to play the part of the ‘other’ quantity. In that case, it is not clear that we have a coherent rate on our hands.

And, even if we did have a rate, would it be a rate of change? (Tallant 2013: 373)

Let me explain the objection as I see it. One can compare the length of a stretch of time with the length of that very stretch of time. Similarly, one can compare the length of a line in space with the length of that very line. Such comparisons are not privileged above other comparisons of spatial or temporal extent; they do not metaphysically illuminate the natures of space or time. In particular, the existence of such rates does not show that part of what it is for lines to have length is for them to have lengths at a rate of 1 m per m, nor that part of what it is for time to pass is that it passes at a rate of 1 s per s. To compare a particular stretch of time with itself is a possible but trivial exercise, which does not metaphysically illuminate how time passes.

In my view, time can be said to pass at 1 s per s (among other rates). If asked how fast time passes, we are being asked to compare the passage of time to the passage of time, and the appropriate answer is: 1 s per s, or 1 hour per hour, etc. Maudlin, Phillips and Van Cleve are quite right about this. As I see it, Price and Tallant press a new question: at what metaphysically illuminating rate does time pass? They press a new argument against time’s passage: if time passes it would pass at some metaphysically illuminating rate, for
which there is no sensible candidate. But I see no force to this argument. I see no reason to think that if time passes, there’s a rate that illuminates how it does so. My proposal says that time’s passage is metaphysically illuminated by statements like: four hours passed from 8am till noon today, and not by any statements about a rate. We’ve seen no argument against this position, no intuitively compelling complaint. (§3 rebuts the allegation that A-theorists must distinguish themselves by positing a metaphysically illuminating rate, and more generally, that A-theorists need to say more about passage than my ideology does.)

Let’s see whether Eric Olson (2009) presents a good argument that passage would have to take place at a metaphysically illuminating rate. He demands a rate of passage on the following grounds.

If an event becomes more past, it must do so at a certain rate: by a certain number of hours in an hour. What is this rate? (Olson 2009: 4)

I also think this is the argument Skow addresses (2011: 328–333). He insists that ’metaphysically uninteresting’ rates of passage are irrelevant to the argument against passage. So he takes the issue to be whether there’s a ’metaphysically interesting’ rate. He does not consider my favoured response, namely that time passes without passing at some metaphysically interesting rate.

In his (2012), Skow again seems to assume that A-theorists must hold that time passes at some metaphysically interesting rate. His discussion “assume[s] that there is such a quantity as speed-through-time. Believers in objective passage certainly accept this assumption.” (2012: 389; cf. 384.) Supposedly, we could adopt a system of units that measures speed-through-time with a fundamental unit (387). I think §§3–6 present an A-theory that endorses ‘objective passage’ but denies there is such a quantity as speed-through-time.
Suppose that I breakfasted at 8am, luncheoned at noon, and it is now 1pm. Let’s consider how lunch has become one hour in the past, before considering how breakfast has gone from 4 to 5 hours in the past.

What it is for lunch to now be an hour in the past is for an hour to have passed since lunch. So when Olson demands to know the rate at which lunch has become one hour in the past, he demands that we compare the length of time that has passed since lunch with the length of time that has passed since lunch. This can be done; Olson’s question is properly answered with the unilluminating rate of 1s per s. There’s no reason here to think that if time passes then it does so at a metaphysically illuminating rate.

Similarly, what it is for breakfast to have become an extra hour in the past since lunch is for an hour to have passed since lunch. So when Olson demands to know the rate at which breakfast has become more past since lunch, he demands that we compare the length of time that has passed since lunch with the length of time that has passed since

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6 I agree with Sanson & Caplan (2010) and Sanson (MS) that A-theorists should analyze the current possession of past-directed properties, such as *having eaten lunch an hour ago*, in terms of the past possession of present-directed properties, such as *eating lunch*. In my view, the basic facts in the vicinity are that I ate lunch at noon, and that one hour has passed from noon until now.

7 Olson replies that 1s per s is equal to the number 1, and hence is not a rate. I am unconvinced: \( f(t) = t \) is a function whose derivative is 1s per s. See also Maudlin (2007: 111–4) and Skow (2012). As I mentioned in footnote 5 above, Skow “assume[s] that there is such a quantity as speed-through-time.” (2012: 389) It’s not clear to me how much of his discussion hangs on that assumption, which I deny.
lunch. Again, the fact that we can make such trivial comparisons does not show that there is a metaphysically illuminating rate at which time passes.\(^8\)

3. Is this conception of passage substantive enough for A-theories?

Let’s relate the foregoing discussion to the A-theory–B-theory dispute. A-theories of time say that past, present and future differ in metaphysical status; B-theories say they don’t. A-theories hold that a metaphysically perspicuous language will use tenses to reflect the different status of past, present and future; B-theories hold there is no such difference in status, and so a metaphysically perspicuous language will not use tenses. A-theories should say that time passes in a meaty sense: there should be change in what’s present, and that’s a result of time passing.\(^9\) B-theories typically say that time does not pass, but they might

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\(^8\) It may be that Olson (2009) is only arguing against a particular—bad—conception of the passage of time. He argues against ‘dynamic’ views, according to which ‘the passage of time is a genuine process of change in the temporal properties of times, events, or persisting objects’ (2009: 4). Suppose he means that ‘dynamic’ views analyze the passage of time in terms of my breakfast’s changing from being four hours in the past to being five hours in the past (and so on). In my view, this inverts the proper order of analysis. The possession of past-directed properties, and changes in their possession, is to be understood in terms of the passage of particular stretches of time (see footnote 6).

\(^9\) A-theories that deny the existence of times and hence of time will need a special gloss for the claim that time passes. See van Cleve (2011, §1) and the passages of Prior (1967, 2003) that van Cleve cites, and Tallant (2010).
say that time passes given a suitably deflated conception.\textsuperscript{10} (As I said in §1, I put Special and General Relativity aside in this paper. We will only consider pre-relativistic A-theories and B-theories, and armchair arguments.)

Some philosophers argue that considerations of rate show that time doesn’t pass, and hence all A-theories are false (cited in footnote 2). Our discussion disarms this generic objection to A-theories: considerations of rate do not show that time doesn’t pass.

A-theories should say that time passes, and so need an attractive characterization of passage—which I’ve supplied. I think the best pre-relativistic A-theory will incorporate the view of passage I’ve suggested. One might worry that this cannot be so. A-theories must endorse a conception of passage that’s incompatible with B-theories, goes the worry. That is, A-theories must say something about passage that B-theories deny. Yet one might think that B-theories can adopt my ideology for talking about passage. Familiar B-theories say that 8am today is four hours earlier than noon (using a tenseless ‘is’). Why not instead say that four hours pass from 8am today until noon? If my conception of passage is thus compatible with B-theories, then A-theories must hunt for a more substantive conception, it is alleged. So goes the worry that my ideology for talking about passage cannot be used to articulate an A-theory. (Maybe this is why some philosophers think that if time passes it does so at a metaphysically illuminating rate (§2.4). Without such a rate, it is alleged, the passage of time deflates to something friendly to B-theories and thus not to A-theories.)

\footnote{B-theorists who say time passes include Savitt (2002, 2009), Dicks (2006), and Dorato (2006). Maudlin (2007: chapter 4, esp. 108–9 & 115) is naturally interpreted that way too, but might be read as rejecting the terms of the A-theory–B-theory dispute. I think we can distinguish A-theories and B-theories even in a relativistic setting (MS).}
Let’s compare two packages that adopt my ideology for talking about passage, an A-theory and a B-theory. Supposing such a B-theory is coherent, we will consider whether my ideology for talking about passage is therefore too deflationary for A-theorists to endorse. Both packages have two components: a way of talking about passage, and a way of talking about states of the universe at other times. The B-theoretic package we’ll consider says: four hours pass from 8am today until noon. It describes states of the world in the following sort of way: at 8am, I eat breakfast (where the predication is tenseless).

The A-theoretic package we’ll explore combines a tensed way of talking about passage with a tensed way of talking about past, present and future states. For example: four hours passed from 8am today until noon; and at 8am, I was eating breakfast.

I am not sure whether the B-theory just described is coherent, but let’s suppose it is. It does not follow that the A-theory just described adopts a B-theoretic conception of passage and hence is either incoherent or in need of supplementation. Our A-theoretic package and our B-theoretic package have different conceptions of passage. The packages’ understanding of passage depends on how they talk about the state of the universe at other times, as well as how they talk about how much time has passed. The A-theoretic package says that at 8am, I was eating breakfast. It uses the past tense to reflect that 8am is gone. That’s part of what it is for some time to have passed since 8am, on this

11 As I’ll explain in §4, my preferred A-theory makes free use of cross-temporal relations. But it would be distracting to bring this up here.

12 B-theories are often explained by analogizing time to space. But spatial distance cannot be glossed as the passage of certain amounts of space. So if a B-theory says that temporal distance is like spatial distance, then it cannot gloss temporal distance as the passage of certain amounts of time.
view. That’s part of how the whole theory presents the passage of time. Talk of amounts of time passing takes on different flavours depending on what other ideology you combine it with. That’s just an instance of the familiar idea that theoretical terms get their meanings from the whole theories in which they are embedded.

No proper part of the A-theoretic ideological package captures the whole package’s conception of the passage of time. The whole package is obviously A-theoretic, with a meaty conception of time’s passing. So we don’t need to hunt for some other claims to add to the package to make it an A-theory. (In light of this section, §2 should really argue that a complete A-theoretic or B-theoretic package fully illuminates the nature of passage without assigning it some rate. It remains clear that no illuminating rate is required.)

4. An unorthodox A-theory

B-theorists can adopt my ideology for talking about passage, and I think A-theorists should do so. But there are challenges for any A-theory that does so. That ideology for talking about passage is incompatible with several orthodox assumptions about what A-theories should say. For example, the proposal talks about past and future times, which is forbidden by ‘quantificational presentism’, the most orthodox A-theory (§6). In my view, the orthodoxies incompatible with my proposal do not deserve their status. They are barnacles impeding the A-theory, and should be scrubbed off. The rest of the paper develops an A-theory that incorporates my view of passage, building on §3. I highlight how appealing the unorthodox features of this A-theory are. My brief discussion cannot be decisive, but I hope to put an attractive new option on the table.
As an A-theory, the proposal uses tenses to talk about how things were, are, or will be, taking these tenses to reflect a metaphysical distinction. When saying how things were at some past moment, it makes explicit what time we are talking about. For example: at 6am on 10th January 49 BCE, Julius Caesar was eating breakfast. However, on this view, there is more to reality than its state at every instant. There are fundamental facts about how much time passed or will pass between pairs of times. Those truths cannot be placed within a specific time; they are cross-temporal affairs. On this view, the transition between times—the passing of time—is a fundamental phenomenon that we need to talk about as well as what happens at particular times.

If a period lies wholly in the past, then it passed; and if it lies wholly in the future, then it will pass. But what if a period of time contains the present moment? Then it’s a period that is passing, I’m tempted to say. For example, 1000 years is passing from the year 2000 until the year 3000. That present progressive tense indicates an on-going process. It is distinct from the stative present tense used to describe the way things are at the present moment. This way of talking about currently passing periods takes very seriously the dynamic nature of reality, which is why it appeals to me; but I don’t insist on it.

The proposal takes the passage of particular amounts of time to be fundamental. It thus makes the temporal metric fundamental, not derivative. Not all A-theories do so. For example, the temporal metric is not fundamental if all the fundamental facts can be stated in a language of tense logic armed only with sentence-operators like WILL, WAS, and NOW. But I doubt that the temporal metric can be recovered from the bare order of events. (I can move my arm though the same arc twice, cycling through the same sequence of states, but that doesn’t mean the gestures took the same amounts of time.)
Nor should we do without the temporal metric. Much better, I think, to make the metric fundamental to the passage of time.

My proposal is not the only way for an A-theory to make the temporal metric fundamental. Another way is to use metric tense operators (Prior 1967, chapter 6). This approach formalizes the claim that I was showering three hours ago as: WAS[3 hours, I am showering]. Instead of talking about times, this approach understands past states by relating them to the present. But how are we to state, at 1pm, that four hours passed from 8am till noon? The closest statement using metric tense operators I can find is roughly: WAS[1 hour, (I am lunching & WAS(4 hours, I am breakfasting)]. I’m unhappy with using descriptions of states to mimic referring to times, but put that thought aside. The metric tense operator view explains the passage of four hours from breakfast till lunch partly in terms of the passage of an hour from lunch until the present. But that seems wrong: the passage of four hours from breakfast till lunch did not metaphysically depend on the passage of one hour from lunch until the present.

I take as fundamental all the facts about the passing of specific amounts of time. For example, the following three facts are all fundamental: 1 hour passed from 8am till 9am, 1 hour passed from 9am till 10am, and 2 hours passed from 8am till 10am. So there is some overlap in the fundamental facts. This might seem profligate, but let’s consider the alternatives (holding fixed the way of talking about passage). Could we say that only the passing of the shortest periods of time is fundamental? No—there are no such things as the shortest non-zero periods of time. Could we say that only the passing of the longest

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13 Metric tense operators avoid reference to past times, but I’ll explain in §6 why that’s no advantage. van Cleve (2011: 143–6) gives a nice brief account of Prior’s views.
period of time is fundamental? This line explains the passing of four hours today from breakfast till lunch in terms of the passing of the whole of time. That doesn’t seem right. Moreover, this line entails that time cannot be infinite. My proposed ideology only talks about the passing of periods that have a beginning and an end. So if only one period of time is fundamental (the longest one), then time must be finite (given the proposed ideology). That seems wrong—the nature of time’s passage does not preclude its passing without end. If we allow all the facts about the passing of finite periods to be fundamental, then we can allow time to be infinite. For an infinite eternity can be characterized by an infinite set of facts about the passing of finite periods. (Given that all the facts about periods passing are fundamental, then I don’t see any advantage to postulating a

metaphysical grounding structure between those facts. Here I agree with Sider 2011: 134, and disagree with Fine 2001: 27 n. 38.)

Now let’s focus on the ideology for talking about states of the universe at a time. Many A-theories treat tense as a sentence-operator, such as WAS(φ) or the metric tense operator WAS[t, φ]. Sentence-operators iterate; for example, WAS(WAS(WAS(φ))) is a sentence. No aspect of my ideology iterates the way sentence-operators do. One can’t take the fact that at T₁ o₁ was F₁, and treat it as the object (say) in a more complex fundamental fact about the state of the universe at some moment. So my proposal does not treat tense as an operator. If this means that tense and modality are not deeply analogous, as orthodoxy supposes, so be it. Nor am I unsettled if the proposal seems divorced from giving a temporal logic, in contrast to the close tie imagined by philosophers who use tense operators to state the fundamental facts. We are concerned with the nature of the fundamental temporal facts, and I see no objection to my proposal.
as to what they are. How they relate logically to the non-fundamental temporal facts, and how the non-fundamental facts relate logically to each other, is not our concern.

The proposed ideology combines tense with reference to times. That’s unusual, partly because many A-theorists eschew all reference to times (see §6 below). Another concern about referring to the time of instantiation is the so-called ‘problem of temporary intrinsics’.

Doesn’t the proposal make shape (for example) a relation between a thing and a time, rather than a property as it should be?—No. The relevant fundamental ideology is: at T, o was F. Talking platonistically: o had the relevant property at time T. A problem only arises if we don’t take the ideology at hand to be fundamental, but rather assume it must be analyzed in terms of having a property simpliciter. For then T would have to be built into the object of predication, or the property predicated, or simply left out. That is, the worry only gets going by refusing to take as fundamental claims of the form: at T, o was F. Here is David Lewis demanding that we explain the ideology I take as primitive:

How is such change [of intrinsic properties] possible?… It is not a solution just to say how very commonplace and indubitable it is that we have different shapes at different times. To say that is only to insist—rightly—that is must be possible somehow. (Lewis 1986: 204)

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How can one and the same thing have contrary intrinsic properties? How does it help that it has them at different times? (Lewis 2002: 1)

(Lewis’s reduction of having a property at a time builds the time into the object of predication—‘temporal parts’ are the real bearers of properties.) Some readers may insist that if F-ness is a property, then objects can be F simpliciter. These readers can add to the fundamental ideology present-tensed claims of the form: o is F.

We should add another class of fundamental fact. As well as facts about the state of the universe at a moment, we already have fundamental facts about time’s passing from one time until another. That’s a cross-temporal fact. So my proposal should allow cross-temporal facts more generally. This is important, as such facts are needed, but are eschewed by certain A-theories. According to one use of the label ‘presentism’, only the present is real, though the past was real and the future will be real; and from this it is supposed to follow that all the fundamental facts are facts about the state of the universe at some moment. My proposal rejects this conclusion: some facts concern how much time passed from one time until another. Moreover, even classical physics needs cross-temporal facts. (See Sider 2001: 27–35, and on the physics, Sklar 1974: 202–9 and Maudlin 2012: 47–66.) In Galilean spacetime, acceleration is absolute but velocity is not. This requires cross-temporal facts, such as that one spacetime point is linearly between two others, or that a path through spacetime is inertial. So much the worse for A-theories that hold that all facts are about how things are at some moment. My proposed A-theory rejects that constraint, because it is incompatible with how the proposal talks about passage. Thus this A-theory can add other fundamental cross-temporal facts to its roster as needed.
5. Reified talk about facts, and the container model of reality

One might worry that my metaphysics is bloated. Are the fundamental facts about the passing of periods of time, and about the past state of the universe, part of present reality?—No. As I’ll explain, this worry stems from philosophically misinterpreting reified talk about ‘facts’.

The A-theory I’ve sketched can be combined with certain innocuous reified talk of ‘facts’ and ‘reality’. We can say that there are facts about how reality was and will be at other times; reality changes; and the facts about the passing of periods of time are fundamental facts about reality and how it changes.

However, what Kit Fine (2005: 268) calls the ‘container model of reality’ is not innocuous. According to the container model, facts are constituents of reality. According to the ‘presentist container model’, reality is wholly constituted by present-tensed facts, like: I am sitting. Of course, reality was constituted by other facts in the past, and will be constituted by other facts in the future. (§6 will discuss a different sense of ‘presentism’: a doctrine about ontological commitment.)

The presentist container model of reality is incompatible with my view of time’s passage. According to the presentist container model, fundamental facts must be constituents of reality at some time or other, and will be facts about the relevant instant. The facts about passage do not meet this criterion: they are not facts about how things are at some instant. In my view, admitting only facts about instantaneous versions of reality leaves out the dynamic aspect of reality, which is essential cross-temporal.
One might respond by replacing the presentist container model with another A-theoretic container model. For example, one could inflate reality at a time to include all the facts about the passing of periods of time, and maybe all the tensed facts about how things are at other times too. Such a view is immune to the objection I made to the presentist container model. But I prefer to retain some of the spirit of presentism and reject the container model of reality. Four hours passed between 8am and noon, but we needn’t think of that fact as a constituent of reality, now or at any other time.

It’s independently plausible that the spirit of presentism requires us to reject the container model. There are facts about what happened in the past, but presentism should deny that those facts are current constituents of reality. The past is gone, though we can still think and talk about it. The normal notion of ‘a fact’ is ‘minimal’: we should treat ‘it is a fact that $p$’ as equivalent to ‘$p$’. Its being a fact that I ate breakfast at 8am is not a matter of some entity, ‘a fact’, existing now and bloating current reality; it solely a matter of what went on at 8am. To think otherwise is to philosophically misinterpret our reified talk of facts. So in the normal minimal sense, there are facts about the past; but they are facts about what is no more, and so do not constitute how reality is now. Thus presentists should say that a fact need not constitute how reality is now. Hence there’s no barrier to

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15 Fine (2005) also formulates an ‘external relativist’ container view of reality, according to which “reality at another time is an alternative reality. It is...another reality on an equal footing with the current reality.” (Fine 2005: 279) Each reality is constituted by present-tensed facts, like: I am sitting. External relativism is also subject to the objection I made to the presentist container model: none of these realities is a proper home for the facts about the passing of periods of time.

16 Minimalism about facts is endorsed in the literature about time by Kierland & Monton (2007: 489), and is taken seriously by Lewis (1999: 216–7).
saying that there are facts about the passing of particular periods of time, but they do not constitute how reality is now.

The past is gone, but there are facts about what happened. Many philosophers deny this platitude; but why? Some insist that “truth supervenes on being”: current claims about yesterday’s breakfast are made true or false by some current aspect of reality. This claim has no force. Current claims about yesterday’s breakfast are made true or false by what happened then, not by what’s happening now.17 True, this means that truth-making is a cross-temporal affair: what happens at one time makes true claims about it made at another. But cross-temporal facts are central to my proposal anyway—the passage of \( t \) seconds from time \( T_1 \) until time \( T_2 \) is a cross-temporal affair. There’s no new commitment here.

It’s a mistake to think that reality is made up of the fundamental facts. It’s also unhelpful to say that reality is constituted by states of affairs, such as my sitting. Reality isn’t simply a succession of composites of states—that leaves out the passage of amounts of

17 Some philosophers try to combine the spirit of presentism with the view that facts must be constituents of current reality, for example Bigelow (1996) and (to explain the costs of presentism) Keller (2004). I agree with Sanson & Caplan (2010) that all these approaches are unappealing. This literature is reviewed by Caplan & Sanson (2011), who note that present truth-makers are also rejected by Gallois (2004: 649) and Tallant (2009: 426). Kierland & Monton think ‘the shape of the past’ is not a matter of ‘things and how things are’, but is some other kind of ‘present aspect of reality’ (2007: 486 n. 3, 491–2). I reject this distinction.

‘Moving spotlight’ views are another kind of A-theory motivated by the desire to fill current reality with truth-makers for claims about the past (see Cameron 2015, esp. chapters 2–3, and Skow 2015). Sanson (MS) argues against these views.
time. In other words, thinking of reality as made up out of states of affairs leaves out the dynamic aspect of reality.

We have to be careful that the way we talk about fundamental facts does not smuggle in the container model of reality. For example, Fine (2001) talks of the ‘facts-in-reality’, which unfortunately suggests that the fundamental facts are in reality. I am happy to say that the fundamental facts about reality are those that belong in ‘the book of the world’ (Sider 2011). On my proposal, that includes certain facts about a past that’s gone, and the facts about the passage of particular quantities of time.

Giving up the container model of reality does not strip claims about fundamentality of their point. We can still say that the fundamental facts metaphysically explain the other, non-fundamental facts, and are not themselves metaphysically explained. For example, facts about how particles moved at 8am this morning metaphorically explain the fact that I breakfasted then, and not vice versa. (Understand metaphysical explanation however you like.) We still want to know what the fundamental facts about reality are, even if they don’t constitute reality like bricks constitute a house.

6. Does this conception of passage have objectionable ontological commitments?

One might object that the best A-theory is ‘quantificational presentism’, an A-theory that holds we should ontologically commit ourselves only to presently existing things, and thus forbids unanalyzed talk of past and future times and objects.18 I admit that my proposed

18 Amongst others, quantificational presentism is discussed sympathetically by Prior (1967 chapter VIII, 1991, 2003), Zimmerman (1991), Bigelow (1996) and Markosian (2004), and
A-theory is incompatible with quantificational presentism. The proposal talks about past times and objects in three ways. Firstly, it talks about the times 8am and noon today (for example) to say that four hours passed from the former until the latter. Secondly, it talks about the time 8am to say that at 8am I was eating breakfast. Thirdly, it talks about objects that don’t exist now, to say how they were or will be. For example, at 6am on 10th January 49 BCE, Julius Caesar was eating breakfast. Allegedly, this means my proposal is committed to quantificational eternalism, the view that past and future things exist, such as 1980 and Julius Caesar, 2100 and Moon Base 1.

Let me gesture at the response I favour. It will just be a gesture—a research proposal, really. Quantificational presentism and eternalism are views about Quinean ‘ontological commitment’. Both those views assume that the correct ideology will be an extension of standard quantificational logic. In particular, all names will refer to something in the domain of quantification, and such referents will make true certain existentially quantified statements. For example, the name ‘Julius Caesar’ would have to refer to Julius Caesar, who would thus be in our domain of quantification, making it true that there exists someone who crossed the Rubicon in 49 BCE. So says the Quinean orthodoxy.

I think that A-theorists should reject these assumptions shared by quantificational presentists and eternalists. According to common sense, we can talk about things that no longer exist or have yet to exist, such as Julius Caesar and Moon Base 1. In 49 BCE, Julius Caesar crossed the Rubicon. That entails that Julius Caesar existed in 49 BCE, but

unsympathetically by Sider (2001 chapter 2). Sullivan (2012) surveys recent work on whether we can formulate a logic hospitable to the presentist assumption that existence can be temporary.
does not entail that Julius Caesar exists.\textsuperscript{19} Similarly, talking about 1980 commits one to 1980 having existed, not to its existing.\textsuperscript{20} A-theorists should treat these claims as platitudes not logical perversions. Let me put the point another way. A-theories need to talk about the past, which is no longer, and the future, which is yet to be. It is very odd to think that we can talk about the past and future only by talking about things that exist now.

But how can there be facts about things that no longer exist? If there are facts about Julius Caesar, then the constituents of those facts must exist now too, one might think. Answering this worry takes us back to §5. It is a fact that in 49 BCE, Julius Caesar crossed the Rubicon; but it is a fact about the past and not about the present. Its being a fact is not a matter of some entity, ‘a fact’, existing now and bloating current reality. Its being a fact is solely a matter of how things were in 49 BCE. So its being a fact requires that Caesar existed then, and not that he exists now.

It would be a major undertaking to survey and respond to the published arguments for the Quinean orthodoxy. I’m not going to attempt to do so here. But I would like to make one pertinent observation. My proposed ideology uses names for objects and times, and no quantifiers. It takes all the quantificational facts to be non-fundamental. That’s a controversial commitment. But if sustainable, it means that picking

\textsuperscript{19} This is not Meinongeanism. Meinongeanism distinguishes being from existence, and would say that Julius Caesar “is” but does not exist. I deny that there is someone who crossed the Rubicon in 49 BCE, though of course there was such a person, namely Julius Caesar.

\textsuperscript{20} I say that there were other times. But what is a time? In a classical setting, we can say that times are points on the temporal dimension. What makes one time distinct from another? I am tempted by the unorthodox structuralist view that the metaphysical nature of a time is constituted by its temporal relations to earlier times.
a convenient and expressive quantificational ideology is irrelevant to identifying the fundamental facts. That takes a whole range of considerations off the board. For example, Sider (2011: 242–5) argues against formulating temporary existence using a fundamental quantifier that contains a slot for a time (to be read ‘there exists at time _ an x such that …’). We would need to quantify into that time slot, argues Sider, and would need a different fundamental quantifier to do so. This proliferation of fundamental quantifiers is too complex and ugly. My proposal does not use any of these quantifiers, so is untouched by Sider’s argument.

7. Conclusion

I proposed a piece of fundamental ideology: amount of time \( t \) passed from time \( T_1 \) until time \( T_2 \). §2 explained why considerations of rate pose no challenge to the passage of time thus understood. A-theories and B-theories can adopt this way of talking about time’s passing, but the results remain different conceptions of passage (§3).

I think the best A-theory will incorporate the proposed way of talking about time’s passing. Any such view refers to other times and accepts cross-temporal facts, and so already disregards certain orthodox constraints on A-theories. I’ve sketched an A-theory that uses at least two pieces of fundamental ideology: amount of time \( t \) passed from time \( T_1 \) until time \( T_2 \); and: at \( T \) object \( o \) was F. It also allows relations holding at a time, and across times, as needed. I’m just concerned to articulate a common-sense view and defend it from a priori objections; it’s another question how far from this proposal our best
physics will take us. Even if you aren’t an instinctive iconoclast, I hope you agree I’ve articulated an intuitively attractive and under-explored A-theory.  

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