Perceiving direction in directionless time

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Abstract

Modern physics has provided a range of motivations for holding time to be fundamentally undirected. But how does a temporally adirectional metaphysics, or 'C-theory' of time, fit with the time of experience? In this chapter, I look at what kind of problem human time poses for C-theories. First, I ask whether there is a 'hard problem' of human time: whether it is in principle impossible to have the kinds of experience we do in a temporally adirectional world. Second I consider the 'easy problem': how specific directed aspects of our temporal experience are to be explained by C-theorists. This leads to a greater issue: is there such a thing as an experience of time direction at all to even be explained? I show how the kinds of experience we have that we typically associate with the idea of time being directed can be accommodated within a directionless picture of time.

1 Introduction

A couple of key questions we can ask about the nature of time are:

A. Does time flow?

B. Does time have a direction?

Question A is famously debated by A-theorists and B-theorists about time. Whereas A-theorists take the various flow-like qualities of our experience of time to reflect an underlying property of the world, namely the flow of time itself, B-theorists reject that time really does flow, holding instead that our experience of time is either illusory in this respect or else includes no such appearance of time flow. This chapter focuses on question B, and the less well-studied distinction between B-theorists and C-theorists about time. Whereas A- and B-theorists hold that time is directed, C-theorists reject this. What, then, can C-theorists say about our experience of time? Do we experience time as directed? And if so, how does this fit with a directionless ontology of time? Or can we legitimately deny that we experience time as directed? This chapter will (1) establish how the C-theorist can accommodate a directed experience of time within a directionless ontology of time, and (2) motivate the claim that we do not even experience time as directed. The plan is as follows. Section 2 sets out in detail what it means for time to be directionless. Section 3 distinguishes between two putative problems about time direction that our experience of time poses for the C-theorist: the 'hard' and 'easy' problems. And section 4 asks whether the direction of time is a perceptual illusion, cognitive error, or neither.

2 What is directionless time?

2.1 Time from A to C.

As the terminology of a C-theory of time is non-standard,[1] let me introduce it. The more well-known A- and B-theories of time are based on John McTaggart Ellis McTaggart's A-series and B-series. McTaggart (1908) introduces the 'A-series' as the series of events 'running from past to future' and the 'B-series' as the series of events 'running from earlier to later', with the key distinction being that only the former is dynamic: events in the A-series change from being 'future', to

[1] It is introduced in Farr (2012).

being 'present' and then finally 'past'; whereas on the B-series, one event's being 'earlier than' another doesn't change in any equivalent way. While both have a direction built into them by way of their ordering relations, the C-series 'has no direction of its own, though it has an order' (p. 462), with McTaggart implying that the central ordering relation of the C-series is something like *temporal betweenness*, which provides an undirected ordering of events in time, one that is invariant regardless of whether one were to look at it from past to future or from future to past.[2]

Whereas a B-theory takes things in time to form a directed ordering by means of the 'earlier than' relation, a *C-theory of time*[3] takes things in time to form an undirected ordering. Imagine some series of events, such as the (rather temporally-extended) writing of this chapter, W, the publication of the book, P, and your reading of this sentence, R. The B-series of these events is W, P, R, since W is the earliest and R latest.[4] On the B-theory, the B-series R, P, W (where the reading is earlier than the publication and writing) would represent a different world to our own, since the events are in different directed ordering. But the C-series of the events is exhausted by the fact that P is *temporally between* W and R; on the C-theory, since the fundamental temporal structure of the world is determined by the C-series of things, there is no such thing as a world just like ours but run backwards; so long as P is temporally between R and W, then we're in the same situation.

2.2 What is a direction of time?

Since we've defined the C-theory in terms of its rejection of a direction of time, we can ask what exactly is a direction of time. It is first important to distinguish

[2] McTaggart (1927) goes on to develop a very different understanding of the ordering relation of the C-series, holding it to be an 'asymmetric' relation. See Farr (2020a) for details. This presentation will assume the C-series is based on something like 'temporal betweenness', fitting with McTaggart's (1908) version.

[3] Farr (2020a, MS, 2012).

[4] Unless, of course, you're reading this preprint prior to the publication of the book.

direction from asymmetry. Undoubtedly the world is full of time-asymmetric processes — processes that have different properties relative to the opposite directions in time. For instance, if we take the outward-radiating ripples on the surface of a pond after being hit by a stone, we can see that from future to past the ripples appear to move inwards, converging on the point of impact rather than spreading outwards. Moreover, the world is full of apparently *irreversible* processes; those that occur in only one direction in time and not the other, such as the dispersing of gases into the wider environment, the smashing of glasses into scattered shards across the kitchen floor, and so on. This class of irreversible processes is subsumed under the Second Law of Thermodynamics, which holds that the entropy of systems (where entropy corresponds roughly to a measure of the randomness of the order of systems) increases over time and does not decrease.

Each process just mentioned, and the Second Law itself, were described in past-to-future terms. But it does not follow that any of these processes, or the Second Law, are directed in time. It is customary for us to describe and represent the world relative to our past-to-future direction, but it is not clear that we would be saying anything false if we were to adopt the opposite convention, and describe the world from future to past. The future-to-past description would still describe the same world with which we are familiar, but from the opposite time-directed perspective. Now we'd have a world in which entropy tends to decrease rather than increase in time. The same asymmetries in time would be present, and so the same laws relating these asymmetries would hold, but their time-directed description would be different. As such, the irreversibility of processes described by the Second Law need not be understood in time-directed terms. Rather, the idea of time as directed is something over and above the existence of time asymmetric and irreversible processes in the world. A privileged direction of time would be equivalent to one set of time-directed descriptions of the world (e.g. past-to-future descriptions) being truer than their counterpart (future-to-past descriptions). Whereas some argue that there are good reasons

to think that past-to-future descriptions of the world are more true than their converse (e.g. Maudlin 2007; Mellor 2009), others have argued that such a view is either unmotivated (Reichenbach 1956; Farr 2020b) or unintelligible (Price 2002, 2011).

There are a range of different strengths of time direction that have been defended by philosophers, ranging from the metaphysically richest idea of a world-wide tide of 'nowness' that flows from past to future, to the most radical antirealist position of the very notion of time directionality being something to eradicate from our description of the world. Existing views can be broken down as follows, in order of decreasing richness.

Directed Nowness. There's an objective 'now' that moves from earlier times to later times.

This is a position commonly held by A-theorists about time.[5] But even those who reject the idea of a moving 'now' can hold a B-theoretic view of the direction of time. A couple of different versions have been defended.

Directed Passage. Time is dynamic and objectively directed from past to future, but without a preferred 'now'. [e.g. Maudlin (2002, 2007)]

Directed Block. Time is non-dynamic but objectively directed from past to future. [e.g. Earman (1974); Mellor (1998, 2009)]

Each of the above positions are *realist* views about time direction in that they take the direction of time to be a feature of the world, independently of our experience, language, and classificatory schemes. C-theories of time, conversely, are antirealist about time direction. There are at least two different ways for the C-theorist to go (for more details about the range of different possible C-theories, see Farr (2020a)):

[5] See, for instance, Zimmerman (2005).

Direction Conventionalism. Time (and processes in time) are not directed; but the convention of describing processes from past to future is either useful or indispensable. [Farr (2020a, 2021); Reichenbach (1956)]

Direction Eliminativism. Time is not directed; nothing is time-directed; all such talk is false and to be eliminated.[6]

Both of these approaches deny that there is anything fundamental or mind-independent about the directionality of time. Where the views differ is that conventionalist C-theories take the use of time-directed descriptions and models as well-motivated by our temporal perspective in the world.

2.3 C-theories: directionless time

C-theories of time reject that time has a direction. A useful way to understand this position is to think of the past-to-future and future-to-past directions as providing different ways of describing the same world. Reichenbach (1956, pp. 31–32) put it this way, holding that 'positive and negative time supply equivalent descriptions, and it would be meaningless to ask which of the two descriptions is true', his point being that there is no sense in which our conventional past-to-future description of everyday processes is any more true than future-to-past descriptions. So, in the case of the apparent arrow of thermodynamics, Reichenbach notes that 'it has no meaning to say [...] that [...] entropy 'really' goes up, or that its time direction is 'really' positive' (Reichenbach, 1956, pp. 128–9). This is not to disparage or undermine the Second Law, but rather to make clear that what the law describes is a set of time-asymmetric phenomena which only has the appearance of a time direction *relative to* our conventional past-to-future description. On this view, the C-theory holds that there is nothing about the nature of time that is in conflict between forwards and backwards descriptions of processes; the two sets of descriptions describe the same reality, with no further

[6] Price (1996, 2002) appears at times conventionalist and at others eliminativist about the direction of time. See Farr (2020a, pp. 10–11) for details.

direction of time in the background. Similarly, the cosmologist and contemporary of Reichenbach, Thomas Gold (1966, p. 327) held that 'the description of our universe in the opposite sense of time [...] is not describing another universe, or how [our universe] might be but isn't, but it is describing the very same thing', adding that such a description may indeed 'sound very strange', but this oddness is due to the unfamiliarity of the future-to-past perspective rather than due to getting something about the world wrong. This way of thinking about C-theories fits particularly well with McTaggart's (1908) presentation of the C-series, since what remains invariant when switching from past-to-future to future-to-past descriptions is the temporal betweenness relations holding between the events described.

The B- and C-theories disagree as to whether there is, beyond our convention of describing things from past to future, a time-directionality belonging to processes in the world, or to time itself. Whereas B-theorists take the direction of time to be a mind-independent feature of the world, C-theorists can take time-directed talk to be false in general (eliminativism) or simply a useful convention due to the human perspective within time (conventionalism). Conventionalism is of more interest in the present chapter as it seeks to accommodate both a directionless ontology of time and the apparently time-directed aspects of human time.

Conventionalism about time direction holds that there are no time-directed facts, but that it is simply more convenient to describe the world from past to future.[7] Since there is no underlying fact about the world that time goes from past to future, then it is not 'false' to describe things from future to past, but such talk goes against our standard conventions. This is a position hinted at by Reichenbach, and consistent with 'perspectivalists' about time direction, such as Price (2007). Reichenbach (1956) holds that although past-to-future and future-to-past descriptions are equivalent in that they represent the same facts, the convention of using past-to-future time to describe processes is not arbitrary; there are good

[7] See Farr (2021) for a defence of conventionalism about time direction.

reasons for preferring to describe the world in a way that accords to the apparent direction of ourselves in time. Intriguingly, Reichenbach takes this to be because future-to-past descriptions of everyday processes 'contradict[…] the time direction of psychological experience' (Reichenbach, 1956, p. 154), implying that we do indeed experience time as directed from past to future.[8] But if the aim of our program is to establish how C-theorists can accommodate the properties of human time, we must ascertain whether the C-theorist need even concede that human time is, or even appears to be, directed.

3 What problems does human time pose for the C-theorist?

Now we've set out the metaphysics of the direction of time, we can turn to our experience of time and how the two relate. These can be categorised into 'hard' and 'easy' problems. First, hard problems take the form: how are direction-like experiences or beliefs possible in directionless time? Behind such questions lies a background disagreement between B- and C-theorists: some B-theorists may claim that a directionless world simply cannot give rise to the kinds of temporal experiences that we have; C-theorists conversely reject such claims, instead implicitly holding that there are no such hard problems of time direction. On the other hand, easy problems concern things such as: Why do we have the 'directed' experiences of motion and change that we do? And what do motion and change illusions tell us about our perception and/or cognition of time direction? Solutions to easy problems would make reference to the specifics of neuroscience, psychophysics, and cognition of change and motion, among other things.

Hard problems can be posed solely for the C-theory (whereas easy problems pose specific puzzles that are independent of which theory of time one adopts):

[8] Similarly, Price (1996, 2007) holds that the direction of causation (from cause to effect) largely depends upon the temporal asymmetries of human agency, and that nonetheless the direction of causation plays an important role in our understanding of the world.

they hold that the C-theory is missing something important, that we could not in principle have the kinds of temporal experience we do, or moreover that there could not exist the kinds of time-directed processes that there appear to be in the world, without time itself being directed. There's a lot to unpack in this idea. First, it is assumed that we have time-directed experiences; second, that there exist time-directed processes. A time-directed experience is one that represents time as being directed or things as being directed in time. Consider the B-theorist Tim Maudlin on this issue. Maudlin defends a version of the hard problem by holding that directionless time would not give rise to the kinds of processes and experiences that exist in our world:

> Nothing happens in [a directionless] world. [...T]he state of [such a] world is so unlike the physical state of anything in our universe that to suppose that there are mental states at all is completely unfounded. (Maudlin, 2007, p. 124).

As such, he argues, we need to assume that time is directed, contrary to the C-theory, in order to explain the fact that there is any experience at all, let alone a specific directed experience of time. It is not clear how the C-theorist can respond to such a worry other than simply to reject the key background assumption and take for granted that the C-theory is indeed consistent with the existence of beings like ourselves. Hard problems such as this set out a dialectical stalemate: to deny hard problems outright, the C-theorist begs the question against the B-theorist by assuming we *can* have the experience we do in directionless time; and the B-theorist in defending hard problems begs the question against the C-theorist by denying this. But such problems have an a priori flavour; the C-theorist of course can't simply rule out the coherence of the idea that directed time is a precondition for conscious experience, but the B-theorist equally cannot rule out the C-theorist's converse view.

This debate again mirrors part of the debate between A- and B-theorists, with Prosser (2012) noting an analogous stalemate exists between realists and antirealists about temporal passage: 'both [passage realist and antirealist] theories,

on their own terms, predict the same experiences[, …and so] experience does not favour one theory over the other' (p. 71). Indeed, Williams (1951) refers to A-theorists who hold that block universe doesn't do justice to temporal experience as 'time snobs', holding instead that the block universe leaves nothing out, and that the concept of temporal passage as being something over and above the spread of events in time is a misleading 'myth'. Williams' contention is that those who reject the A-theory do not seek to undermine the phenomenal qualities of temporal experience, but rather hold that no part of our temporal experience requires that time has an extra property of 'passage' to explain it. Similarly, I have argued (Farr, MS) that C-theorists indeed seek to take the directional aspects of our temporal experience and representations seriously; they simply reject that these require, or would even be well explained by, the posit that time has an intrinsic direction.[9]

To focus the issue on the directed aspects of temporal experience, it's easy enough to pose the following argument against the C-theory:

1. We have time-directed experiences; things appear to us to go from earlier to later.

2. We could not have such experiences unless time itself is directed, or processes are themselves directed in time (from earlier to later).

3. The C-theory rejects that time itself is directed and that processes are directed in time.

4. Therefore the C-theory is incompatible with our temporal experience, and hence false.

The C-theorist has various options here. Primarily, they may reject either (or both) of the first two premises, and conventionalist C-theorists could quibble

[9] Paul (2014) considers the hard problem, offering a series of ways in which the 'reductionist' about the arrow of time (i.e. the C-theorist) can respond to the objection that temporal experience is inconsistent with their ontology.

with the content of premise 3. Premise 2 presents a version of the hard problem; the idea that it is in principle impossible for a directionless time to give rise to the kind of experience of time that we have. As noted, I don't intend here to offer a defence of the C-theory against the hard problem, since the C-theory is predicated on the contention that all of our beliefs and (putative) experiences of the direction of time follow from a directionless ontology of time coupled with the various details of physics, chemistry, biology, psychology, sociolinguistics etc. In this way, the C-theorist takes the relevant problems about time direction to be the 'easy' problems: how exactly it is that we come to have the beliefs, representations and experiences about the direction of time that we do. In order to ascertain the size of this task, we must first establish in what sense our experience of time is directed; in other words, we'll consider what the C-theorist can say in response to premise 1. This turns out to be a surprisingly understudied topic, to which we now turn.

4 Does human time have a direction?

We've seen that for the C-theorist physical time is not directed. But to what extent is human time directed? There are a range of different positions on this that one may take, from the view that we literally experience time as though it is directed from past to future, to the view that it is a mistake to think that we can even have a coherent belief that we experience time as directed. In order to spell out the different possibilities here, we can first look to the positions that have been defended by B- and C-theorists with respect to the *passage* of time, before constructing analogous positions for the C-theorist with respect to the *direction* of time.

First, a terminological note. The issue at the centre of debates about temporal experience is whether our experience has phenomenal qualities that correspond to certain metaphysical views about time. So, we can ask whether we experience things *as though* time is passing; and in our case, we are interested in whether

we experience things *as though* time is directed. Paul (2010, 2014) refers to such experiences as 'experiences as of' passage or direction, others have framed the issue in terms of whether we have 'passage phenomenology', and I've (Farr, 2020c) called these 'temporal qualia'. Where I use these terms in the following discussion they are interchangeable. However, one reason I prefer the latter terms (phenomenology or qualia) is that the term 'experience as of' implies that the relevant experience has some particular representational content, such as experience as of passage representing time as passing. As I have argued elsewhere (Farr, 2020c), this very issue is central to the debate — there are various reasons why B- and C-theorists may wish to reject that temporal qualia/phenomenology even represents time as passing, and as I argue in this section, there are plausible reasons for the C-theorist to reject that our experience represents time as being directed.

4.1 Degrees of temporal experience

The question of whether the passage of time is something experienced by us has received plenty of attention in recent years, with a range of positions being defended. Those who reject that time really does pass, namely B- and C-theorists, can hold that we have illusory experience of time as passing, a false belief that we experience time as passing, or simply that there is no aspect of our temporal experience or cognition that aligns with the idea of time as passing. I'll go through each in turn.

Phenomenal illusionism. We have a phenomenology of time as passing that is illusory in that it represents something that does not exist. [e.g. Paul (2010); Prosser (2012)]

This corresponds to the idea that we experience time *as though* it passes. For example, there might be some unifying 'passage quale' that accompanies our experience of things in time, or instead that our experience of things like change

and motion involve a faulty representation of time as passing. For the illusionist B- or C-theorist, either of these constitute an illusory projection of time as passing. Paul (2010) argues that those who reject the A-theory may regard the appearance of flow or animation that accompanies a perception of change or motion as a creation of the brain in representing change or motion: 'a stage of one's brain *creates the illusion* of such flow, as the causal effect of prior stages on (this stage of) one's brain' (Paul, 2010, p. 352; my emphasis). However, many non-A-theorists have rejected the idea that time even *appears* to pass, being *eliminativist* about passage phenomenology:

Phenomenal eliminativism. There is no aspect of our experience of things in time (e.g. change, motion, etc.) that corresponds to a phenomenology of time as passing. [e.g. Deng (2013a, 2019); Hoerl (2014); Farr (2020c)]

We can subdivide eliminativism into cognitive and non-cognitive versions, both of which being eliminativist about passage phenomenology (denying that there we have experiences 'as of' passage), but disagreeing as to whether we commonly have the *belief* that we have passage phenomenology.

Phenomenal cognitivism. Though we do not have phenomenology of time as passing, we are subject to a systematic and false set of *beliefs* that we do have such phenomenology.

Cognitivism holds that we are in the grip of a cognitive error when we think that our experience is as though time is passing, and has elsewhere been referred to as 'cognitive error theory' (Miller et al., 2018) due to its similarities with the structure of moral error theory.[10] The idea behind this position is that although we do not have a phenomenology of passage — we do not experience time *as*

[10]There is an unfortunate terminological ambiguity here. In the case of time, illusionism has come to refer to those who hold that we have passage phenomenology but that time does not really pass, and cognitivism is a distinct position denying that we do have passage phenomenology. However, cognitivism is closely related to the 'illusionist' theory of consciousness of Dennett (1993), Frankish (2016) and others, who hold that we falsely believe that we have certain kinds of phenomenology (like experiencing the 'redness' of seeing red things).

though it passes — we nonetheless *believe that we do*. Miller et al. (2018) set out a series of ways in which we can come to the false belief that we have passage phenomenology. However, this doesn't exhaust the possible options, nor does it capture the views of those who simply reject talk of passage as metaphorical in nature or even conceptually incoherent.[11] To accommodate this even more minimal claim about temporal phenomenology, we need an extra option:

Phenomenal non-cognitivism. We neither have a phenomenology of passage nor a systematic false belief that we do. Instead, our tendency to describe or model human time as having the appearance or feeling of passing or flowing is metaphorical in nature and does not ascribe such a property to our temporal experience.

The idea behind non-cognitivism is that our ways of talking about our experience of time, or things in time, invoke evocative metaphors such as the flow of rivers or passage of objects through space but do not assert propositions about time capable of being true or false. In this way, passage-talk is akin to how moral non-cognitivists regard moral talk — as expressing (for example) attitudes or expressions towards objects or behaviours. So in the case of passage, the non-cognitivist would regard phrases like 'time flows forever like a river' as functioning as a kind of aesthetic attitude towards time rather than a statement of fact about some property possessed by time.[12]

Before moving on to the case of time-direction perception, it's worth elaborating on the distinction between cognitivism and non-cognitivism. The point at issue is whether the best way to philosophically categorise our talk and experience of time is in a cognitive or non-cognitive manner. Despite its lack of explicit

[11]For instance, I argue (Farr, 2020c) that it is an unhelpful mistake in the philosophy of perception to relate the kinds of qualia associated with real or illusory motion and change perception to the idea of time as passing.

[12]One might think that cognitivism vs non-cognitivism presents a straightforward empirical question: do the folk have the belief that they have passage phenomenology? Indeed, this question has been put to the test — see Latham et al. (2020) and Shardlow et al. (2021) for dissenting views on this issue, and Norton (2021) for an overview of this disagreement.

defence in the literature, there are plausible motivations for non-cognitivism. While there is something it is like to see change and motion, which is commonly associated with the idea of passage, some have suggested that these aspects of experience do not give rise either a projection of time as passing or to a coherent belief that time passes. For instance, Hoerl (2014) suggests that because the very concept of time passing is self-contradictory or otherwise incoherent, we simply cannot have a coherent belief that we experience such a thing. In Farr (2020c), I defend a position termed 'reductionism about temporal qualia', suggesting it to be an error-free account of our perception of things like change and motion. Though there is a specific phenomenology associated with perceiving real or illusory motion or change — motion qualia and change qualia —, I argue that these are simply what it's like to perceive or project motion and change in the world, and that there is no reason to categorise such qualia as pertaining to the idea of *time* as passing (nor things as 'passing' through time). As such there is no false belief about temporal passage to be explained.

4.2 Do we 'perceive' the direction of time?

With these positions in place, can we lay out an equivalent set of options in the case of the *direction* of time? Immediately there are two options here: one might hold that the only sense in which we can have time-direction phenomenology is through having passage phenomenology. This appears to be the view of Le Poidevin:

> [I]f, by 'the direction of time' we mean more than mere asymmetry, then this is due to our sense of time's passage, and this, it is plausible to suggest, is something we do not perceive, but rather project. (Le Poidevin, 2015, p. 469).

This suggests that there is nothing more to having time-direction phenomenology than having temporal passage phenomenology, and so if one rejects that we have passage phenomenology, this verdict carries over to the case of time-

direction phenomenology. This view is attractive insofar as the prime candidates for time-direction phenomenology are also those appealed to as temporal passage phenomenology, namely change, motion, and succession.

Directed change. We typically experience the change of some object (e.g. a change in the brightness of an old lamp) as directed — things change *from* some earlier state *to* some later state.

Directed motion. We typically experience the motion of some object (e.g. a car driving down the street) in the direction from earlier to later times, such that its spatial motion is in the direction from the earlier location to the later location.

Directed succession. We typically experience sequences of events as later events *succeeding* earlier ones, and not vice versa (e.g. when hearing a descending musical scale).

While experiences of change, motion and succession are typically associated with some flow-like or dynamic qualia that is often related by philosophers to the idea of time as passing, there is nonetheless an element of directionality in each experience that is conceptually distinct from the dynamic, passagey part.[13] The alternative option is to hold that there is a distinct sense in which time might appear to us as directed, as implied here by Simon Prosser:

> We experience time as having a direction. [...T]his [...] strikes me as easier to explain than most of the other features of experience that have seemed to be in tension with the B-theory. For although passage entails directionality, directionality does not entail passage. (Prosser, 2016, p. 204)

[13]For instance, Deng (2013b) makes the case against Le Poidevin that experiences of succession can be considered veridical on the B-theory, since succession—the sense that one thing appears to another—is not an essentially A-theoretic notion but fits with the time-directed ontology of the B-theory.

On this latter view, the idea that we have direction-of-time qualia is distinct from, and less controversial than, the idea that we have passage qualia. It is this idea that I'll explore further in this section: Is there a specific sense in which we have either a phenomenology of time direction or a systematic belief that we do that the C-theorist is required to make sense of? As with the case of passage, we can delineate a series of options for the C-theorist with regard to our purported experience of the direction of time. Firstly, illusionism:

Phenomenal time-direction illusionism. We have a phenomenology of time as being directed from past to future that is illusory in that it represents something (the direction of time) that does not exist.

And for phenomenal time-direction eliminativism, the C-theorist has the following options:

Phenomenal time-direction cognitivism. Though we do not have a phenomenology of time direction, our experience and cognition of time, change, motion, succession, and other related aspects of experience, leads us to the false *belief* that we do have such phenomenology.

Phenomenal time-direction non-cognitivism. Our experience of change, motion, etc., do not give rise to a phenomenology of time as directed nor a coherent belief that we have such phenomenology. Time-direction talk is at best non-cognitive (e.g. metaphorical) in nature.

In what follows, my aim is simply to demonstrate that in this range of options, the C-theorist has ample resources to make sense of the various features of human time within the context of an adirectional metaphysics. In principle, each of these is a viable option for the C-theorist. I'll consider each in turn, starting with illusionism.

4.3 Phenomenal time-direction illusionism

The phenomenal time-direction illusionist holds that we have some kind of phenomenology of the direction of time, such that we are subject to a phenomenal illusion regarding the direction of time. There are two different ways in which this might be the case: first, that there is a time direction quale that typically accompanies temporal experiences — a kind of pure experience as of time being directed; second, that more mundane kinds of perception, such as motion perception, involve a representation of processes as being directed in time.

Is there a 'direction quale', namely a sense of something being directed that is independent of motion and change qualia? One approach to this is to look at cases in which awareness of direction is dissociated with awareness of motion. While ordinarily motion illusions involve an unambiguous sensation of directed motion, Seno et al. (2012) outline a purported case of 'directionless vection'. Vection is a 'conscious perception of self-motion' which is ordinarily accompanied with an apparent direction, 'perceived heading', and speed, 'egospeed' (Palmisano et al., 2015). In the study of Seno et al. subjects were presented with a combination of stimuli that resulted in a reported sense of motion without perceived heading or egospeed. Interestingly, this is suggestive of the idea that one can have an apparent perception of motion without perception of direction, and so, abstracting away from this, we could entertain the idea of direction qualia and motion qualia being distinct things.

However, this is not to suggest that there is anything in the way of empirical grounds for supposing that there is unique 'direction-of-time' qualia that we are in any sense subject to. In general, the relationship between direction qualia and direction-of-time qualia is unclear, and there is certainly a metaphorical jump from the former to latter when appealing to experiences of motion as putative experiences as of the direction of time. In the case of directionless vection, rather than taking it to show that direction-of-time qualia could be distinct from motion qualia, one could instead read the result as evidence that there can be awareness of motion with an ambiguous *spatial* direction with respect to positive time.

If we give up the idea of a pure quale of time direction, the illusionist can instead hold that things like motion, change or succession qualia (what it is like to see real or illusory motion/change/succession) involve a conscious representation of time as directed. What does it mean to experience a motion or change in such a way that it involves the representation of time being directed? One way to think of this is that we invariably take our experiences of such things to be directed from past to future. For instance, when I experience a car moving towards me, it is taken for granted that my experience is of the motion of the car relative to the past-to-future direction of time: the perception of the car as directed in space (i.e. towards me) encodes a direction of time (i.e. the direction in time relative to which the car is moving towards me). With change and succession, the situation is slightly different. When I see a coloured light change from red to green, there is clearly a sense in which I experience it as changing in a directed way *from* red *to* green. Once again, this corresponds to direction of change relative to the past-to-future direction and not the future-to-past direction. And with succession, there is once more a clear sense in which we take an experience of one event succeeding another as directed from the earlier event to the later event. So in each such case, insofar as we appear to experience processes as directed, either with motion, change or succession, the direction of the process itself implies a direction of time. In this way, the illusionist might hold that a sense of time direction is a part of experiences of direction.

Illusionism is a plausible option for the C-theorist. There is nothing straightforwardly contradictory in holding time to be undirected, and processes being undirected in time, whilst our experience of processes in the world involves a representation of them as directed in time. Paul (2014) entertains such a view, firstly making the case that there is a clear sense in which we have experience 'as of' a direction of time:

> [W]e have phenomenal features of our experiences involving causal impressions and causal direction, and phenomenal features involving temporal anticipation. Putting them together, we can see the be-

> ginnings of an account of how our cognitive system could construct our experience so that it presents the world to us *as* an evolving, causally governed, productive universe. (p. 187)

For instance, Paul cites examples of 'temporal anticipation' as putative experiences 'as of' the direction of time, where we have the 'phenomenological feel of having an experience with an anticipatory or predictive unfolding character' (p. 186), such as seeing a rock precariously teetering over the edge of a cliff and *feeling* as though the rock is about to fall. Paul's point is that there is a class of experiences related to anticipation, prediction, and causal inference that are clearly directed from past to future. Secondly, Paul suggests that the 'reductionist' about time direction (those that hold facts about the direction of time to reduce to facts about the time-asymmetric entropy gradient; i.e. one way in which one could be a C-theorist) could potentially hold that 'our experience as of temporal direction is merely our visual and other cognitive systems' response to entropy gradients' (p. 190). One can relax the details about entropy gradients and simply understand illusionism as holding that there can be an experience 'as of' time direction on the C-theory insofar as a time-asymmetric processes in the world can collectively give rise to a phenomenal projection of processes as being directed in time. This is certainly a plausible enough position since processes in the world are standardly thought of as experienced from earlier to later times.

4.4 Phenomenal time-direction cognitivism

The C-theorist may wish to reject illusionism. It is true that when experiencing a direction of motion or change there is an implied direction of time — the direction of time relative to which one's judgements about the direction of motion or change are correct. However, the C-theorist can deny that this amounts to a phenomenological representation of time being directed. There are a couple of phenomenal eliminativist options here that correspond to cognitivism and non-cognitivism respectively. First, the cognitivist can hold that we merely have the

background belief that the experience we have is relative to the past-to-future direction and not the future-to-past direction. And second, the non-cognitivist can hold that it is simply more convenient to make use of the past-to-future direction rather than the opposite time direction to describe or represent our experiences, but that this does not correspond to a belief that our experiences are directed from past to future. I'll go through these options in this and the next subsection respectively.

If the C-theorist rejects illusionism, and so rejects that we have a phenomenology of time direction, can they offer an explanation as to how we can come to falsely believe that we do? One place to look for such a view is the 'enduring self' conception of time defended in varying ways by Velleman (2006), Ismael (2006), Prosser (2012) and Callender (2017). The central idea is that the appearance of time as directed and flowing owes in part to our conception of ourselves as temporally-extended beings coupled with the nature of memory formation and recall. As Velleman summarises,

> I exist in my entirety at successive moments in time, thereby moving in my entirety with respect to events. As I move through time, future events draw nearer to me and past events recede. Time truly passes, in the sense that it passes me. (Velleman, 2006, pp. 12–13)

Prosser (2012, p. 107) notes that it is 'this notion of a single entity passing 'through' a change that captures at least a very important element of the experience of temporal passage.' While both of these authors focus on the notion of the extended self as providing an explanation for the belief in the *passage* of time, it is clear that the asymmetry of memory formation — the fact that we have memories only of earlier events, and subsequently that memories generally accumulate over time — brings also a sense of time directionality that is conceptually distinct from the sense of passage or flow.

Reichenbach's own conventionalist account of time direction draws on a similar-sounding explanation for our conventional preference for describing things from past to future:

> That [a language of increasing entropy] appears to us as a more natural language, that we are so strongly disposed toward the identification of the direction from interaction to order with positive time, has its basis in the nature of the human organism. (Reichenbach, 1956, pp. 154–5)

> Why is the flow of psychological time identical with the direction of increasing entropy? [...] The answer is simple: Man is a part of nature, and [their] memory is a registering instrument subject to the laws of information theory. The increase of information defines the direction of subjective time. (Reichenbach, 1956, pp. 269–70)

In both cases here, what we see is a defence of the usefulness of the past-to-future mode of describing the world that is based on the structure of human memory formation. This account is based on the assumption that the asymmetry of memory — why it is that we have memories of the past but not of the future — is due to the time-asymmetry of entropy.

In Reichenbach's (1956) wider program, the existence of a monotonic entropy gradient in our region of the universe (where entropy steadily increases in one temporal direction but decreases in the other) underpins other modal asymmetries, such as the asymmetry of cause and effect (why it is that causes precede their effects in time and never vice versa) and the asymmetry of intervention (why it is that interventions have a significant effect on the future of systems but leave their past unchanged). This general program of deriving the modal asymmetries of causation and intervention from facts about the entropy gradient has been developed by Albert (2000), Kutach (2002, 2013) and Loewer (2007, 2012) by analysing such asymmetries in terms of the existence of a low-entropy constraint at one temporal end of the universe — the so-called 'past hypothesis'. Following this program of grounding the time-asymmetry of knowledge (that we have specific kinds of knowledge of local contingent facts about the past but not the same kind of knowledge of the future) in terms of the entropy gradient, others such

as Hartle (2005), Ismael (2017) and Callender (2017, ch. 11) have developed accounts of why beings like us take ourselves to operate as agents towards the future, making predictions and decisions about the temporal future on the basis of information about the temporal past, creating a sense of ourselves as future-oriented decision-makers. Such accounts, if adopted by the C-theorist, naturally fit with cognitivism, as they can be understood as giving rise to the belief that we experience time as directed from past to future since this is direction in which we function as agents. However, even this claim can be resisted by the C-theorist in favour of non-cognitivism.

4.5 Phenomenal time-direction non-cognitivism

Can the C-theorist plausibly reject that we even have a belief that we experience time as directed? One way to do so is to hold that it is simply more convenient to represent or describe our experience from past to future than from future to past, and that this convention falls short of a belief that our experience is directed from past to future. This view amounts to a conventionalist account of human time direction, fitting with the conventionalist account of physical time direction outlined in sec. 2.3.

4.5.1 Conventionalism about human time direction?

Interestingly, conventionalism about human time direction is perhaps what is meant in the above Reichenbach quote when he notes '[t]he increase of information defines the direction of subjective time'.[14] The non-cognitivist can ultimately *define* the direction of human or subjective time to be that which matches the direction of growing memories, etc., and so matching the direction of increasing entropy. It is clearly useful to do so since this matches up with the apparent

[14]Reichenbach's position on the direction of human time is ultimately unknown. It would have been the topic of the final part of *The Direction of Time*, but he died before it had been written. In her editing of the book, Maria Reichenbach notes this, and includes in the appendix notes from Reichenbach's public lectures on human time.

directionality of agency. But the C-theorist is not required to hold it to be true human time is 'really' directed from past to future, merely that this is a more useful way to describe or understand it. On such an account, as with the directionality of entropy, it is not strictly false to say that human time 'goes' from future to past, but rather that we do not use that particular convention for a variety of reasons. On this reading, when holding it to be 'inconvenient' to describe the world from future to past since it would 'contradict[…] the time direction of psychological experience' Reichenbach (1956, p. 154) is not referring to time direction as an element of human experience, nor even human time as intrinsically directed, but rather taking it to be unusual and ultimately pointless to describe humans relative to the future-to-past direction.

Building from these lines of reasoning, the C-theorist can take human time to be directed from past to future insofar as it is useful to stipulate that human lives are oriented from past to future. It is useful because this direction makes sense of the directionality of agency, that humans are agents that deliberate about an unknown future based on the knowledge of the past and present. Given this stipulation, it follows that our experience of things like change, motion and succession are time-directed in the sense that the experience itself is best described and understood from past to future and not future to past.

4.5.2 Veridicalism about C-time

An alternative option for the non-cognitivist C-theorist is *veridicalism*. The veridicalist C-theorist holds that all temporal experience and beliefs about temporal experience accord to what it would be like for the C-theory to be true. What is meant by this? The C-theorist can regard each of the putative kinds of directed experience — e.g. change, motion and succession — to involve experience of objects' changing properties across time, and regard them as directed only relative to a choice of time direction (i.e. the past-to-future direction). Consider the case of perceiving the spatial motion of an object, such as the car moving towards me. In such a case, the veridicalist C-theorist holds that what

we are perceiving is the change in position over time. From past-to-future, this accords to car moving towards me, and from future-to-past, this accords to the car moving away from me. For the veridicalist, what is being perceived is the car moving in space from point X to point Y relative to the same time direction in which the perceiver is growing older, accumulating memories, and so on, and equivalently the car moving from Y to X relative to the same direction of time in which one is growing younger. What is perceived here, in other words, is the relative temporal ordering of the motion of the car and the ageing of the perceiver, where 'temporal order' concerns which events are temporally between which other events; in other words the C-series rather than B-series. As such, the veridicalist C-theorist can hold that our temporal experience is exactly how it would be were the C-theory true, and that in order to reject this view one would need a substantial argument to the effect that a C-theoretic world would somehow 'seem' different to ours.[15]

4.5.3 Time direction as conceptually incoherent?

As with the case of passage, a motivation for phenomenal non-cognitivism is the questionable conceptual coherence of a direction of time. In the case of passage, one might object that we can't literally think of time as appearing to flow or pass, since flow and passage are merely metaphors: it is clear what it means for a river to flow or a moving object to pass by oneself, since these are processes that take place over time. But time itself cannot have the same literal properties since time cannot flow or move relative to itself.[16] At face value, the idea

[15]On this point, it is hard not to be reminded of G.E.M. Anscombe's (1959, p. 151) story about her conversation with Ludwig Wittgenstein about geocentricism. When Anscombe notes to Wittgenstein that geocentricism was intuitive because it just 'looked as if the sun went round the earth', Wittgenstein responds 'what would it have looked like if it had looked as if the earth turned on its axis?' Of course, the answer is that it would look exactly the same. Analogously, the C-theorist can defend the claim that everything is exactly as it would appear were their theory true, and that to think otherwise would be a misconstrual of what the C-theory predicts about our experience.

[16]Some, e.g. Skow (2012), have bitten the bullet here and simply postulated to existence of a second time relative to which ordinary time passes or flows.

of time as being directed is less conceptually problematic than time passing or flowing, but there is nonetheless reason to think it is not wholly unproblematic. Imagine a car driving down the street, and suppose we consider the car as moving in the direction of the distant end of the street, away from us. The car is 'directed' insofar as it moves towards a particular point in space (the far end of the road) relative to positive time, i.e. the direction towards what we call the 'future'. If we picture this four-dimensionally, the trajectory of the car is denoted by a vector pointing in the direction of positive time. And if we were to view this trajectory relative to reverse time — from future to past — the car would appear to be moving backwards, away from the far end of the road and towards the observer. It is only *relative* to a choice of positive time that we can hold the car to be directed in one direction rather than the other. Similarly, one can hold that experiences of change and succession are only directed *relative to a choice of positive time*. As such, it is unclear what it can mean for time to be directed, since each definable direction of time (past-to-future and future-to-past) are 'positive' relative to themselves. Can we say that time moves forward over time, or that time is a vector in time? Both are problematic ways of talking since they appear either tautologous, or to make reference to a second-order time variable.[17] As with passage, the non-cognitivist could in principle say that because the concept of time direction is incoherent, it follows that it is not coherent to believe that we experience time as directed.

5 In sum…

To sum up, while C-theorists deny that time is directed, there is a wealth of plausible options available to the C-theorist for making sense of our experience of

[17] A popular mathematical means of representing time as directed is to understand the direction of time in terms of a temporal orientation — a continuous, non-vanishing timelike vector field on a relativistic spacetime (Earman, 1969, 1970, 1974; Weingard, 1977), but such a view amounts to a conventional stipulation of one of the two definable temporal directions as the 'positive' direction (Price, 2011).

time. With respect to the ontology of time, I have argued that the C-theory need not be understood as strictly eliminativist about the direction of time, but rather can be understood in conventionalist terms, such that under certain conditions it is overwhelmingly preferable to describe the world from past to future. With respect to human time, we have seen how the C-theorist can hold that: (1) our experience of time constitutes the illusion that time is directed; or (2) our temporal experience coupled with background beliefs give rise to the false belief that time appears to be directed; or (3) it is simply useful to talk *as though* our experience of things is directed from past to future; or (4) the world appears to us exactly as though the C-theory were true. In each case we see plausible strategies for accommodating the allegedly 'directed' aspects of human time within a C-theoretic picture of time.

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