**Temporal Experience, Temporal Passage and the Cognitive Sciences**

**Abstract**

Cognitive science has recently made some startling discoveries about temporal experience, and these discoveries have been drafted into philosophical service. We survey recent appeals to cognitive science in the philosophical debate over whether time objectively passes. Since this research is currently in its infancy, we identify some directions for future research.

1. **From cognitive science to philosophy**

Investigation of temporal phenomenology by the cognitive sciences has bourgeoned in the last couple of decades. Though this area is still in its relative infancy there has already been a suite of surprising discoveries. Eagleman (2008) reviews a number of so-called temporal illusions. For instance, it has been shown that the order in which events are judged to have occurred can be reversed, and that simultaneity judgements can be manipulated, as can judgements about the duration between events. It has also been shown that subjects can come falsely to believe that the effect of an action occurs before that action, even when the subject performs the action in question (Stetson et al (2006)). In what follows, we review philosophers’ recent appeals to cognitive science in the debate over the Temporal Passage Thesis (TPT), which states that time objectively passes. We note that the precise nature and limitations of the role of cognitive science in adjudicating philosophical disputes in this area is yet to be adequately discerned and we point towards some future avenues of research. First, we will state TPT and set out a prominent argument in its favour (2.1). Then, we will outline recent attempts to block this argument using empirical findings from cognitive science (2.2). Finally, we will slate three general issues for future research (3).

1. **Is there temporal passage?**
	1. **Temporal passage and the argument from experience**

The metaphysical thesis we will discuss is the following:

**Temporal Passage Thesis (TPT):** The passage of time is an objective feature of reality.

The Temporal Passage Thesis says that time passes: times move from being future, through being present, to being past. Furthermore, it says that this movement of times is objective: it’s not mere subjective change resulting from the change in an individual’s perspective, as is the “movement” of places from far away to nearby that you experience when you go on holiday. The temporal passage thesis has a venerable history in philosophy including Broad (1923; 1938), Prior (1967; 1968); 1970) Gale (1968) and Schlesinger (1980; 1994). Recent advocates include Smith (1993); Craig (2000); Crisp (2003); Markosian (2004); Baron (2014), Bourne (2006), Bigelow (1996), Monton (2006), Sullivan (2012), Tallant (2012), Tooley (2000) and Zimmerman (2005

A prominent argument for the Temporal Passage Thesis is the *argument from experience.*[[1]](#footnote-1) This argument pushes us to accept the objectivity of passage by claiming that unless we do so, we can’t explain certain aspects of our temporal phenomenology. Until relatively recently, the argument from experience was not explicitly stated. Instead, what typically happened is that one would appeal to the apparent ‘whoosh’ and ‘whiz’ of temporal experience, or to the sense we are moving into the future and away from the present, and take the appeal to such putative pieces of phenomenology as sufficient to motivate the temporal passage thesis (see, for instance, Davies 1995, Schuster 1986, Zwart 1972 and Williams 1994). More recently, however, Skow (2011), Paul (2010), Le Poidevin and Prosser (2000, 2007, 2012, 2013) have added a new rigour to the debate over the passage thesis by attempting to explicitly formulate and assess arguments that move from the experience of passage to the truth of the passage thesis. The rough idea is that since we all have experiences as of time passing[[2]](#footnote-2), and since the only reasonable way of explaining these experiences relies on the existence of actual passage, we should accept the existence of actual passage. We can set out the argument as follows. (See Paul 2010, 357 and Le Poidevin 2007, 95, who formulate the argument along these lines; see Skow (2011) for variants on this argument.)

**The argument from experience**

1. We have experiences as of the passage of time.
2. If we have experiences as of the passage of time, then any reasonable explanation for this relies on the passage of time being an objective feature of reality.

Therefore:

TPT. The passage of time is an objective feature of reality.

The inference from (1) and (2) to TPT involves an inference to the best explanation: if the existence of passage provides the only reasonable explanation for our experiences as of passage, then *a fortiori* it provides the best explanation. We won’t discuss the status of this inference; we’ll focus instead on the argument’s premises.

The argument from experience presses us to accept temporal passage on the basis of its alleged explanatory indispensability. The thought is that we must provide some reasonable explanation for our experiences as of passage, and that any such explanation will inevitably rely on the objectivity of passage. Premise (1) is typically supported by a direct appeal to phenomenology: surely you can *just tell*, the claim is, that your temporal phenomenology represents the world as containing passage (see, for instance, Craig (2000, 2001), Le Poidevin (2007), Prosser (2007) and Smith (1994)). The second premise is typically supported by two thoughts: that the presence of passage would render our temporal phenomenology veridical, thus providing a simple and reasonable explanation of it; and that no purported explanation of our temporal phenomenology that *doesn’t* rely on passage could be a reasonable one (see Skow (2011) for an extended discussion of the basis for this second premise). Call those who defend TPT on the basis of the argument from experience *passage theorists*. Passage theorists thus accept (1), (2) and TPT. Passage theorists include, but are not limited to, Craig (2000), Craig (2001), Gale (1968), Hestevold (1994), Le Poidevin (2007), Maudlin (2002), Maudlin (2007), Norton (2010), Prior (1968), Schuster (1986), Smith (1994) and Zimmerman (2005, 2008).

Call those who reject TPT *no-passage theorists*. If no-passage theorists accept the inference from (1) and (2) to TPT, then to block the argument from experience, they must reject either (1) or (2). *Veridicalists* reject (1), thereby denying that we have experiences as of passage. They thus dispute the passage theorist’s claim about our temporal phenomenology. Hoerl (2014), Baron and Braddon-Mitchell (ms.) and Braddon-Mitchell (2013) are veridicalists. *Illusionists*, on the other hand, accept (1) but deny (2): they accept that we have experiences as of passage, but claim that these experiences can be explained without relying on passage. Illusionists thus hold much of our temporal phenomenology to be illusory: they say that our experiences represent something (namely, the existence of passage) that isn’t in fact the case. Illusionism is by far the most popular position amongst no-passage theorists. Advocates include Callender (2008), Lee (2014), Mellor (1981, 1998), Paul (2010), Price (1997, 2011), Prosser (2000, 2007, 2012, 2013) and Skow (2011).

In order to successfully block the argument from experience, no-passage theorists must meet an explanatory challenge. They must explain how we have the temporal phenomenology we do, without relying on the existence of passage. For the veridicalist this amounts to explaining, first, what the content of the experiences that we typically take to represent passage really is, given that they do not in fact represent passage; and, second, why it is that so many of us mistakenly believe that these experiences represent passage, when in fact they don’t. For the illusionist, the challenge is to explain how our (illusory) experiences as of passage arise, without relying on passage. (In the interests of fairness, one might also challenge the passage theorist to explain our experiences as of passage in a way that *does* rely on passage.[[3]](#footnote-3)) Arguably, the illusionist’s explanatory challenge is more taxing than the veridicalist’s, since explaining how our phenomenology is systematically mistaken seems more difficult than explaining away certain false beliefs about the content of experience.[[4]](#footnote-4)

We will focus primarily on the illusionist. The claim that some item of phenomenology is illusory is the kind of claim that cognitive science is in the business of exploring and understanding. It therefore seems reasonable to suppose that advances in cognitive science will have a bearing on the broad explanatory project before the illusionist.[[5]](#footnote-5)

Note that there are two ways in which an explanation of our temporal phenomenology might rely on passage, both of which the illusionist must avoid. First, an explanation might rely on passage e*xternally*: it might say that our temporal phenomenology is caused in part by passage in the external world. The illusionist must avoid such explanations: while she admits that we have experiences as of passage, she must not explain them as successful detections of passage. Second, an explanation of our temporal phenomenology might rely on passage *internally*: it might rely on passage in giving an account of the cognitive processes that occur in our brains and are responsible for our experiences as of passage.[[6]](#footnote-6) The illusionist must also avoid this: it won’t do if on her account our cognitive processes rely on passage for their operation, even if those processes don’t constitute successful detections of passage.

To clarify the distinction between internal and external reliance, consider the following analogy. Imagine a “no-water theorist”, who claims that despite the suggestive nature of your hydrological experiences—your apparent experiences of water glittering in the sun, drumming on the roof, dumping you onto the sandbar, and so on—there is no water. The anti-water theorist faces an explanatory challenge: she must explain your hydrological experiences without relying on the existence of water. First, her explanation must not rely on water externally: she mustn’t explain your hydrological experiences as being caused by external lakes, rain, oceans, and so on. Second, her explanation must not rely on water internally: for example, her account of the cognitive processes that occur in your brain and are responsible for your hydrological experiences mustn’t rely on your brain’s being wet.

The illusion theorist thus faces an explanatory challenge: she must give an explanation for our temporal phenomenology that does not rely (either internally or externally) on the existence of passage.

* 1. **Cognitive science and passage**

No-passage theorists have a history of appealing to the physical sciences in an attempt to explain the way we experience the world temporally (Price 1996; Dyke and McLaurin (2002); Hartle 2005; Kutach (2011); Feinberg, Lavine, and Albert (1992); Loewer (2012); Suhler and Callender 2012). More recently, however, illusionists in particular have turned their attention to the empirical findings of cognitive science (see Callender (2008) Le Poidevin (2007) Suhler and Callender (2012) and Paul (2010). In a moment, we’ll discuss some of the illusionist’s attempts to avoid external reliance on passage and then to avoid internal reliance. First, however, it is worth saying a bit more about the methodological backdrop against which the illusionist is working.

Although cognitive scientists seldom explicitly endorse a particular philosophical approach to phenomenal content, they do make certain assumptions in their analysis of illusory experiences. Consider, for example, their standard procedure for distinguishing illusory experiences from veridical ones. They first note that experiences of a certain kind co-vary with some feature of the world, F—that is, that these experiences tend to occur in the presence of F, and not in its absence. They then suppose that these kinds of experiences represent F. On occasions when such an experience is had in the absence of F, they suppose that experience to be illusory; and they ask in virtue of what features of the world, F\*, that experience was had. This typically involves giving an account of why F\* “tricked” the brain into thinking that F was present. In the case of motion, for example, the cognitive scientist first notes that certain kinds of experiences co-vary with the presence of motion in the external world, thereby supposing that these experiences represent motion. She then notes that in certain circumstances we have such experiences in the absence of motion. She declares these experiences illusory and sets about explaining how the brain is “tricked” into having experiences as of motion in the absence of motion. This methodology fits very naturally with the main naturalistic theories of representation: the *co-variational* theory, which says that phenomenal content represents that feature of the world that co-varies with it; the *causal* theory, which says that it represents that feature of the world that (typically) causes it; and the *functional* theory, which says that phenomenal content is a function both of what the relevant phenomenology is caused by, and what it causes (Millikan 1984, 1989; Stampe 1977; Dretske 1981; Fodor 1990). The methodology of cognitive science seems to be neutral between any of these views; it implicitly supposes only that the representational content of an experience derives at least in part from the existence of an appropriate relationship (co-variational, causal or functional) between that experience and the feature of the external world that the experience represents.

*Prima facie*, however, all of these accounts are in tension with the illusionist’s view. For while the illusionist claims that our experiences represent the world as containing passage she must deny that these experiences are appropriately related to passage in the external world, since she denies that passage exists.[[7]](#footnote-7) Accordingly, it’s difficult for her to maintain that our temporal phenomenology is illusory: to be illusory—in the standard sense used in cognitive science—there should be some cases in which our passage phenomenology co-varies with whatever it represents, and some where it is tricked. According to the illusionist, however, it is never co-varying in this way: we are always being tricked.[[8]](#footnote-8) Of course it’s open to the illusionist to reject such naturalistic theories of phenomenal content; and there are those who think there are independent reasons for doing so.[[9]](#footnote-9) But the illusionist is in an awkward position: on the one hand she appeals to empirical findings about illusions in order to block the argument from experience; but on the other, her own view is in tension with the account of phenomenal content implicit in the methodology that generated those very findings (see Braddon-Mitchell 2013).

It is somewhat unclear what illusionists should say about phenomenal content. The best way to reconstruct their position, we believe, is as follows. Illusionists accept a naturalistic account of our phenomenal content *and* say that our temporal phenomenology is illusory by endorsing a very close connection between passage phenomenology and motion phenomenology (see, in particular, Paul (2010) for this line of thought). [[10]](#footnote-10) Some of these illusionists then suggest that our phenomenology as of passage is either wholly or partially characterised by our experience as of motion -- that is, our experiences as of objects in motion in the external world -- in that our experiences as of passage are partially composed of, or supervenient on, our experiences as of motion (Le Poidevin 2007, p. 76), perhaps in consort with our phenomenology as of change (Paul 2010, p. 346). Others suggest that our temporal phenomenology is relevantly analogous to the experience as of motion (Davies 1995, Schuster 1986, Skow 2011).[[11]](#footnote-11) To see how appealing to the connection between motion and temporal phenomenology might help the illusionist, suppose that passage phenomenology is just a special case of motion phenomenology, in which the thing experienced as being in motion is a special thing, namely time.[[12]](#footnote-12) Then perhaps a naturalistic account leaves room for (all) our passage phenomenology to be illusory. Perhaps experiences as of passage have their illusory content because passage phenomenology is a special case of moving-thing phenomenology, which *is* in general (despite some exceptions) appropriately related to moving things. (Compare: on a naturalistic account, one’s visual phenomenology might represent purple monkeys, despite not being appropriately related to purple monkeys, because it’s part of a wider class of experiences that is appropriately related to purple things, and another wider class that’s appropriately related to monkeys.)

Assuming that the illusionist tells a story about phenomenal content along the above lines, she will then proceed to explain our experiences as of passage without saying that they constitute veridical detections of passage in the external world. One way of doing so is to rely on the relationship just discussed between our temporal phenomenology and our motionphenomenology.[[13]](#footnote-13) Of particular interest here are motion illusions, e.g., the motion after-effect and phi motion[[14]](#footnote-14), in which one has experiences as of motion, when in fact nothing in the external world is in motion. It has also been found that one can have experiences as of motion without corresponding experiences as of position change.[[15]](#footnote-15) From these empirical findings about our motion phenomenology, some illusionists (Paul 2010) draw a conclusion about our passage phenomenology; namely, that since we can have experiences as of motion without corresponding motion in the external world, we can plausibly have experiences as of passage without corresponding passage in the external world. And since cognitive science not only shows *that* motion illusions arise, but also *explains* *how* they arise without external reliance on motion, such illusionists argue that a similar explanation should be available regarding the illusion of passage. In this way, such illusionists hope to explain our temporal phenomenology without external reliance on passage.

Illusionists have also appealed to cognitive science in attempting to explain our temporal phenomenology without internal reliance on passage. The challenge here is to give an account of the cognitive processes responsible for our temporal phenomenology in such a way that these processes do not rely on passage for their operation. (Compare: the dry brain.) Again, the alleged connection to motion is crucial. On the basis of empirical findings, illusionists claim that one can have experiences as of motion simply by perceiving static stimuli—i.e. stimuli that are instantaneous or highly temporally localised—flashed at different locations.[[16]](#footnote-16) Indeed, according to some cognitive scientists, motion can be conceived of as “painted” onto our experience of discrete, static, properties.[[17]](#footnote-17) If that is right then an explanation of our experiences as of motion can be obtained by appealing only to the static properties of objects at locations and the static properties of brain structures at times. We thus allegedly have an account of the cognitive processes responsible for motion phenomenology that is independent of temporal passage.[[18]](#footnote-18) Then we can parlay this into an account of the cognitive processes responsible for our temporal phenomenology that does not rely on passage. Again, the persuasiveness of this argument depends on how closely related these two kinds of cognitive processes are. It’s most persuasive if the temporal phenomenology processes are a subset of the motion phenomenology processes; in that case, a passage-free account of the motion phenomenology processes also constitutes a passage-free account of the temporal phenomenology processes. But even if the processes are only partially overlapping or merely analogous,[[19]](#footnote-19) or if motion phenomenology processes require supplementation by other ingredients from cognitive science to explain the experience as of passage (which most cognitive scientists suppose is so)[[20]](#footnote-20), the thought is, the result is suggestive.

In claiming that her account of temporal phenomenology is passage-free, doesn’t the illusionist beg the question against the passage theorist? (See for instance Hartle 2005 and Prosser 2012, p. 111-2). For in the course of giving this explanation, the illusionist makes free use of entities with temporal features, such as stimuli and brain states that occur *at times*. But the passage theorist may claim that any reasonable explanation of these temporal features will itself rely on passage: part of what makes them *temporal*, she might say, is the existence of passage. Thus, even if the passage theorist accepts that the illusionist’s explanation is a good one, she will deny that it is passage-free. Furthermore, cognitive science seems not to help the illusionist show that her explanation is passage free, since its language is neutral with respect to passage: this language just refers to temporal features of stimuli and brain states, without taking a stand on whether these features must ultimately be explained in terms of passage.

The illusionist can respond that her appeals to cognitive science do not aim to show that the TPT is false. Rather, they aim to block a particular argument for TPT, namely, the argument from experience. The argument from experience relies on the alleged explanatory indispensability of passage. Consequently, if the illusionist can successfully explain temporal phenomenology in passage-neutral terms—appealing only to stimuli, brain states, and so on, as described in the passage-neutral language of cognitive science—then she will have successfully blocked the argument from experience. There is, of course, the further question of whether all features of the explanans can *themselves* be explained without relying on passage. The passage theorist may deny that they can; but to support this claim she’ll need an additional argument. She will need to show that certain non-phenomenal features of stimuli and brain states can be explained only by relying on passage. There may be such an argument, but it’s not the argument from experience.

This clarifies one aspect of the relationship between cognitive science and TPT. Provided the illusionist appeals to cognitive science only to block the argument from experience, her strategy is sound. (Of course, we can ask whether the resulting explanation is a good one, and so whether her blocking attempts succeed; see below.) However, should she go a step further and attempt to use the explanation offered by cognitive science to give an independent argument *against* TPT, then she will become vulnerable to the above criticism. Since the explanation offered by cognitive science is couched in passage-neutral terms, it does not rule out the existence of passage; and so it’s limited to playing a blocking role. (Of course, if the argument from experience is the *only* serious argument in favour of TPT then this blocking could prove decisive.) The moral: while the alternative explanation offered by cognitive science can (if it’s a good one) be used to block the argument from experience it doesn’t constitute an independent argument against TPT.

1. **General conclusions**

The discussion of the illusionist’s alleged question-begging raises the issue of the proper role in metaphysical debates of the explanations provided by empirical science. Philosophers often defend the existence of certain entities (or aspects or features of reality) by claiming them to be indispensable parts of any reasonable explanation of some aspect of our experience. Such arguments may be blocked if empirical science supplies an alternative explanation of the relevant parts of our experience that do not explanatorily rely on the entities in question. As the above discussion shows, however, we must be careful not to overreach: if the alternative explanation does not rule out the existence of the contentious entities (as seems *prima facie* plausible, if the explanation is couched in suitably neutral scientific language), then the corresponding appeal to empirical science will not in itself provide an argument *against* the contentious entities. In such circumstances, the proper role of the relevant alternative explanation is a blocking role: it is best suited to undermining indispensability arguments in favour of the existence of certain entities, or to undermining the claim that certain theses offer the best explanation for some phenomenon, and not to giving independent arguments against the existence of certain entities. Developing a more complete formulation of this constraint, and considering how it applies in particular cases, would be a worthwhile project.

Next, consider the above discussion of the apparent tension between the illusionist’s position and naturalistic accounts of phenomenal content. This discussion constitutes a warning: since empirical results can rest upon philosophical assumptions, we should exercise caution in appealing to empirical results to settle philosophical debates. Philosophers are of course under no obligation to agree with scientists on matters of philosophy; but when appealing to empirical work to defend a philosophical thesis they must be aware of the philosophical claims presupposed by the empirical work in question. The important issue isn’t whether some particular scientist or experimental procedure happens to take questionable philosophical claims for granted; it’s whether the methodology that generates the relevant empirical findings *relies* on those questionable claims, in the sense that the findings must be discarded if the claims are rejected. If the science is ultimately separable from the philosophical assumptions that happen to suffuse it, then that’s well and good. But this separability claim ought to be defended by the philosopher who seeks to appeal to empirical work in buttressing her philosophical claims. Establishing that such claims are separable in this manner would seem to be another fruitful avenue of future investigation.

Finally, consider our discussion of the illusionist’s reliance on the alleged close connection between motion phenomenology and temporal phenomenology. To defend her response the illusionist has work to do both in stating the precise nature of this alleged connection and in arguing that it holds. Note that appealing to extant empirical findings won’t help much: while cognitive science says plenty about motion phenomenology, it says precious little about passage phenomenology, and still less about the relationship between the two. Furthermore, there are reasons to be sceptical that this issue can be settled empirically, given the difficulty of isolating our passage phenomenology. The usual methodology of cognitive science seems inapplicable: one can’t vary the presence of passage and see how subjects respond, because it’s a matter of debate whether passage is present in any given case. (And indeed, one thing that everyone does agree on is that the presence of passage can’t be varied by an experimenter!)

Instead, what’s needed is a *philosophical bridging argument* connecting passage phenomenology to motion phenomenology. Such an argument would aim to justify the inference from the cognitive scientist’s empirical findings about motion phenomenology, to the illusionist’s empirical claims about temporal phenomenology. The details of this connection thus require further development.[[21]](#footnote-21) One possibility might be to decompose passage phenomenology into various constituent phenomena, and individually link each constituent to empirical experiments involving motion (or other relevant phenomenology), thereby building many small bridges rather than one big one. In any case, as things stand, even if a passage-free account of motion phenomenology can be given, further work is required in order to translate this into a passage-free account of passage phenomenology as the illusionist requires.

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1. See Skow (2011) for a useful overview of arguments from experience. For further discussion, see Prosser (2007, 2012, 2013) and Paul (2010). [↑](#footnote-ref-1)
2. A terminological note: we’ll often need to describe an experience in terms of its qualitative features, without presupposing that it has any particular relationship to any particular kind of external stimulus. To do this, we will use the phrase ‘an experience as of’. The claim that one has experiences as of passage does not presuppose that passage exists; it just says that one’s temporal experience represents the world as containing passage, and that this experience makes it seem to one that this is the case. [↑](#footnote-ref-2)
3. Skow (2011) pursues this, arguing that the explanation of the experience of passage provided by passage theorists is not good. [↑](#footnote-ref-3)
4. It is worth noting that one limitation in appealing to cognitive science to resolve disputes between passage and no-passage theorists is that passage theorists seldom offer an explicit characterisation of the experience as of passage. The phenomenology is instead often characterised as being like certain other experiences, such as motion. Indeed, some passage theorists might hold that the relevant experiences are best characterised simply as the experience of intrinsic A-properties. If their view is thus characterised then it is difficult to see how they could appeal to cognitive science to vindicate their view, since plausibly there is no way even in principle to determine whether some feature of our cognitive system is tracking intrinsic A-properties. Nevertheless, what passage theorists can do is try to undermine the strategy of no-passage theorists by attempting to show that they cannot explain our phenomenology without appeal to passage. [↑](#footnote-ref-4)
5. Cognitive science is also plausibly relevant to the veridicalist’s explanatory project. For example, Hoerl (2014) argues that the systematic misinterpretation of our temporal phenomenology as being phenomenology as of passage can be explained by certain structural features of the phenomenology of perceptual experiences of movement and change. We will not pursue this issue in detail here. [↑](#footnote-ref-5)
6. Admittedly, our notion of ‘internal’ is general: as characterized in the broad terms of ‘an account of the cognitive processes that occur in our brains and are responsible for our experiences as of passage’, an internal account may involve neural correlates of experience (Lee 2014), models of such processes (Treisman 1984, Dainton 2011) and/or the structure of experience itself (Phillips 2010, Phillips forthcoming-a, Watzl 2013). We will remain neutral about these various options and simply survey the general prospects for an illusionist’s appeal to cognitive science. [↑](#footnote-ref-6)
7. The veridicalist avoids this tension. She can accept that the content of our temporal experience is given by the feature of the world with which it co-varies, since she holds that neither the content nor the cause is passage. [↑](#footnote-ref-7)
8. See Norton (2010). [↑](#footnote-ref-8)
9. See Pautz (2010) for instance. [↑](#footnote-ref-9)
10. It pays to be careful here, for motion phenomenology and the cognitive science thereof is currently being investigated in two quite different ways within philosophy. On the one hand there are those, such as Paul (2010), who look to what cognitive science has to say about motion phenomenology with an eye to ultimately undermining a particular metaphysical thesis about the nature of time. On the other hand, there are some, such as Dainton (2008) and Phillips (2010), who look to the very same scientific research with an eye to developing a greater understanding of the cross-temporal unity of consciousness, allegedly brought to light by reflection on the specious present. These are two quite different debates and they should not be run together. One can hold a position on the cross-temporal unity of consciousness quite independently of one’s views about the nature of time and vice versa. The debates are orthogonal, though they do draw on similar work in cognitive science. For a good overview of the second debate, see Dainton (2008). [↑](#footnote-ref-10)
11. Note that both the veridicalist and the illusionist employ such an inference, although the illusionist does so twice: once to avoid external reliance on passage, and once to avoid internal reliance. (The veridicalist plausibly needs only the latter.) [↑](#footnote-ref-11)
12. Some deny that it makes sense to understand phenomenology as of passage as phenomenology as of moving time, because it makes no sense to say that time moves. (For example, one might argue that motion is variation with respect to time, and that time cannot vary with respect to itself.) If this is right, then the third response considered here is not viable. [↑](#footnote-ref-12)
13. Anti-passage theorists typically also appeal to our *change* phenomenology (See, especially, Paul (2010)), but for brevity we will focus on motion. While the empirical findings regarding the two are different, the philosophical uses to which illusionists put them are similar. [↑](#footnote-ref-13)
14. For the motion after-effect, see (Nishida & Johnston, 1999) and <http://www.michaelbach.de/ot/mot_adapt>. For phi motion see (Tyler, 1973; Steinman, Pizlo, & Pizlo, 2003). [↑](#footnote-ref-14)
15. This is thought to be because there is a partial anatomical segregation of motion processing from other visual processing in the brain. Experiences as of position change with little sense of motion have been reported when viewing special displays (Lu, Lesmes, & Sperling, 1999) and with ordinary displays viewed by so-called motion-blind patients (Zihl et al 1983). [↑](#footnote-ref-15)
16. See for instance Paul (2010). [↑](#footnote-ref-16)
17. See (Crick & Koch, 2003). It is worth noting that Crick and Koch’s conclusions are explicitly based on the wagon wheel illusion in continuous lighting, first discussed in Purves and Andrews (1996). There is now considerable dispute regarding whether Crick and Koch’s interpretation of that experiment is correct. See Kline (2004). Nevertheless, Crick and Koch's hypothesis has considerably broader support, e.g. from the motion after-effect (Wohlgemuth (1911)) and the dissociations of motion from position change (Lu, Lesmes, & Sperling, PNAS 1999). Also note there are alternatives to Crick and Koch’s ‘painting’: our experience as of motion has been proposed to arise from, to some extent, a construction (Grush 2007) or projection (Le Poidevin 2007), both of which arguably appeal only to static properties. [↑](#footnote-ref-17)
18. Though for a contrary view see Hoerl (forthcoming) for an argument to the effect that the illusionist problematically equivocates two senses of ‘static’. [↑](#footnote-ref-18)
19. See Phillips (2012) for discussion. [↑](#footnote-ref-19)
20. [↑](#footnote-ref-20)
21. For a recent attempt to provide such an argument, see Callender (ms.). [↑](#footnote-ref-21)