Temporal Experience[1]

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I step out of my house into the morning air and feel the cool breeze on my face. I feel the freshness of the cool breeze *now*, and as the breeze dies down, I notice that time is passing—I need to start walking or I'll be late for class.

We all know what it is like to have these sorts of experiences. Reflection on the qualitative character of such experiences suggests that events occurring now have a characteristic property of nowness, responsible for a certain special "feel," and that events pass from the future, to the present, and then into the past. The question I want to explore is whether we should take this suggestion to support an antireductionist ontology of time, that is, whether we should take it to support an ontology that includes a primitive, monadic property of *nowness* responsible for the special feel of events in the present, and a relation of *passage* that events instantiate in virtue of literally passing from the future, to the present, and then into the past. It will be important in what follows to avoid prejudging whether the world actually does include nowness and passage, so I'll use the locution "as of" instead of just "of" when I want to signal that descriptions like "experience as of passage" merely describe experiences with a certain qualitative character.

It should be obvious that we need to take temporal experience seriously: experiences as of nowness and as of the passage of events are central to our subjective perspective. In some deep but hard to define way, our temporal experience is caught up with our sense of being, i.e., our sense of what we are and how we are. (Heidegger engages this idea in his *Being*

[1] Thanks are due to Michael Bruno, Daniel Dennett, Kit Fine, Joshua Knobe, Robin LePoidevin, Ned Markosian, Sarah Moss, Brad Skow, Ted Sider, and to members of the audience at talks given to Psychology and Philosophy departments at the University of Arizona, UCLA, Berkeley, and Wake Forest. I'm especially grateful to Tyler Doggett for his insightful comments on earlier versions of this paper and to Brian Scholl for discussion of contemporary experimental psychological work on real and apparent motion.

and Time, and Husserl develops an account of the way our consciousness of temporality connects with perceptual experience.)[2] Making sense of the features of temporal experience is fundamental to our ability to make sense of the world and of ourselves as agents in the world, and bears important connections to one's having a point of view and to one's sense of being a self.

One central way in which temporal experience is taken seriously is when it is cited by antireductionists as evidence for the existence of nowness and passage. But do events really have properties of nowness—or do they just seem to? Do events literally pass from the future into the past—or do they just seem to? These questions come down to the question of whether, to account for temporal experiences as of nowness and passage, we need to endorse an antireductionist ontology of time, or of events in time, that includes nowness and passage. Must we grant the existence of a primitive property of nowness and of a relation of passage, or do we merely need to grant that we have experiences *as of* nowness and *as of* passage?[3]

There is more to be said. In addition to accounting for our temporal experiences as of nowness and passage, we need to account for the way we, at least pre-theoretically, seem to experience qualitative change. One standard ontological characterization of change of object *O* defines qualitative change in *O* as *O*'s having suitably intrinsic property *P* at time *t1* and *O*'s having suitably intrinsic property *Q* (instead of *P*) at time *t2*. A feature of this definition, however, is that *O*'s having *P* at time *t1* never changes, and *O*'s having *Q* at time *t2* never changes. Paraphrasing Mellor (1998), one might be inclined to reject this ontological

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[2] Heidegger, M. (1962) *Being and Time*, tr. Macquarrie and Robinson, Harper & Row and Husserl, E., (1990) *On the Phenomenology of the Consciousness of Internal Time (1893-1917)*, trans. J. B. Brough, Dordrecht: Kluwer [1928]. The work of Heidegger and Husserl does not engage with the reductionist-antireductionist debate as I am framing it.

[3] "now" and "present" can be used interchangeably.

characterization of change because it seems to reduce change to a series of changeless events.[4] Intuitively, the rejection is motivated by an antireductionist understanding of change as something involving more than just changeless events: to have change, it has to be the case that there is also passage, so that there is a flow of successively existing events (and their corresponding property instances), from the future into the present and off to the past. The inference is that this flow of successively existing events is responsible for the animated character or flow of change, which is necessary for real change.

We can cash out the overall antireductionist claim about change more precisely as the claim that, first, for *O* to change from being *P* (at t_1) to being *Q* (at t_2), the event of *O*'s having *P* must become present at t_1 and then the event of *O*'s having *Q* must become present at time t_2 (while the event of *O*'s having *P* is not present at time t_2). Second, that we detect this change in virtue of detecting its flow or dynamic character. Antireductionists infer from this that, for there to be real change, there has to be passage, cashed out as the successive nowness of different events moving from the future to the present and into the past. In order to avoid prejudging whether real change requires passage, in what follows, I'll use "experience as of change" to describe an experience where we seem to detect a flowing or animated change, and occasionally I'll refer to "flowing" or "animated" change to describe change defined as actually involving passage.

Ontologists think that our ordinary judgments drawn from our experience of the world can give us knowledge about the world, and that we can use this knowledge, perhaps via a route involving some conceptual analysis, to develop metaphysical theories about what

[4] Mellor, D. H. (1998). *Real Time II*. London: Routledge.

there is.[5] My comments above are designed to elucidate the way that some ontologists, who I've labeled "antireductionists," are inclined to hold that our ordinary judgments drawn from our temporal experiences tell us there are monadic properties of nowness in the world responsible for our experience as of nowness, and relations of passage (sometimes also called the "flow of time" or "becoming") responsible for our sense as of passage. Such a view holds that our experience as of the nowness of events is best explained by ascribing the irreducible, monadic temporal property of nowness to events and that our experience as of the passage of events is best explained by holding that that time actually passes; i.e., that events do not merely stand in unchanging relations of being earlier than, later than or simultaneous with other events. On this sort of view, experience is taken to provide an almost non-negotiable starting point for a metaphysics of time.

Donald Williams characterizes the situation thus: "The final motive for the attempt to consummate the fourth dimension of the manifold with the special perfection of passage is the vaguest but the most substantial and incorrigible. It is simply that we *find* passage, that we are immediately and poignantly involved in the jerk and whoosh of process, the felt flow of one moment into the next. Here is the focus of being. Here is the shore whence the youngster watches the golden mornings swing toward him like serried bright breakers from the ocean of the future. Here is the flood on which the oldster wakes in the night to shudder at its swollen black torrent cascading him into the abyss" (1951, 465-6).[6]

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[5] For an account of the role of ordinary judgments in ontology, see Paul, L. (in press), "A New Role for Experimental Work in Metaphysics," *Review of Philosophy and Psychology*, special issue edited by Knobe, Lombrozo and Machery. For a description of a standard methodological approach in metaphysics, see Paul, L. (in press) and Paul, L. (manuscript), "The Handmaiden's Tale: Metaphysics as Ontological Modeling."

[6] Williams, D. C. (1951) "The Myth of Passage," *Journal of Philosophy* 48, 457-72.

Antireductionist views rely, either explicitly or implicitly, on these sorts of intuitive views about our experiences as of nowness, passage and change when they argue that mind-independent temporal properties such as nowness and passage actually exist. Some defend the intuitive plausibility of presentism based on the fact that we have experiences as of the temporal properties of nowness and passage. For this sort of presentist, nowness is what makes the present ontologically special, and passage is the ontological ground for events coming into or out of being. (See, for example, Craig 2000 and Schlesinger 1991.)[7] Some instead defend a moving spotlight view, where as time passes, events come into being or have different ontological statuses depending on whether they exist now, i.e., if the spotlight shines upon them, or not. (See, e.g., Broad 2001[1938] or Smith 1993).[8] Some positions are a little harder to box up, but seem to rely on antireductionist intuitions. For example, Maudlin, in defense of a thesis about the direction of time, says that "Above and beyond and before all these considerations, of course, is the manifest fact that the world is given to us as changing, and time as passing… all the philosophizing in the world will not convince us that these facts are mere illusions" (p. 135) and "[i]n sum then, it is a central aspect of our basic picture of the world that time passes, and that in virtue of that passage things change" (p. 142).[9] Or consider Skow: "I cannot survey all the motivations philosophers have had for the moving spotlight theory. But the motivation that I like best appeals to the nature of our conscious experience. Of all the experiences I will ever have, some of them are special.

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[7] Craig, W. (2000). *The Tensed Theory of Time*. Dordrecht: Kluwer Academic Publishers and Schlesinger, G. N. (1991) "E pur si muove" The Philosophical Quarterly 41, 427-41.

[8] Broad, C. (2001, [1938]). "Ostensible Temporality," in M. Loux, *Metaphysics: Contemporary Readings*, Routledge, 272-278, and Smith, Q. (1993) *Language and Time* (New York: Oxford University Press).

[9] Maudlin, T. (2007) *The Metaphysics Within Physics* (Oxford: Oxford University Press). Maudlin is not actually defending passage as it is usually defined, viz., as involving events literally passing from the future to the present and into the past. He is defending the view that time has a direction. But the quote evokes standard antireductionist intuitions, even if, strictly speaking, Maudlin does not endorse them.

Those are the ones that I am having NOW. All those others are ghostly and insubstantial. But which experiences have this special feature keeps changing. The moving spotlight theory explains this feature of experience: the vivid experiences are the ones the spotlight shines upon. As the spotlight moves, there are changes in which experiences are vivid" (§IV).[10] Or Hare's description of the motivation for endorsing ontological properties of nowness and passage: "realism about tense is uniquely capable of making sense of the phenomenology of temporal experience" (§1).[11] Such antireductionist intuitions involve an element of naturalness and common sense that many philosophers find appealing.

Not everyone is impressed. *Reductionists* argue that for reasons of ontological parsimony, we should not postulate the existence of fundamental properties of nowness or passage unless we have better ontological and empirical reasons to do so. They hold that there is no reason to take these features of our experience as ontologically robust, since there is no sufficiently attractive metaphysical or empirical reason for endorsing the existence of nowness or passage. According to reductionists, what exists is an ontologically tenseless, fourdimensional universe of events, with each event or temporal stage of the universe located at a particular time, and events stand in unchanging relations of being earlier than, later than or simultaneous with other events. (See Mellor 1998 for a good defense of this view.) There are no primitive monadic properties of nowness, events don't literally pass from the future into the past, and every stage of the fourdimensional universe is on an equal ontological footing, temporally speaking. On this view, real change of *O* from *P* to *Q* is simply the ontological fact of *O*'s having suitably intrinsic property *P* at time t_1 and *O*'s

[10] Skow, B. (in press). "Relativity and the Moving Spotlight," *Journal of Philosophy*.
[11] Hare, C. (in press). "Realism About Tense and Perspective," *Philosophy Compass*.

having suitably intrinsic property *Q* (instead of *P*) at time t_2, so real change does not require passage.

The objection to such reductionist parsimony is to charge that such views cannot account for the character of our experiences as of the now and our experiences as of passage. We need properties of nowness and passage to explain the fact that we have experiences as of nowness and passage (and change). In general, the objection to the parsimonious view is that that without the properties of nowness and passage, we'd have no way to account for the features of our temporal experience. Since we do have experiences as of the now and we do have experiences as of passage and as of change as flowing or animated, the reductionist's parsimony is a false economy.

What I've just described gives us an intuitive way to characterize the nexus of a philosophical debate over the ontology of time. The antireductionist holds that temporal properties of nowness and passage exist (as opposed to it being the case that it is merely *as if* such properties exist), and that real change requires passage. The antireductionist's parsimonious opponent is the reductionist: she holds that there are no properties of nowness or passage, and that change is just the replacement of properties at successive times.

As I noted, antireductionists want to argue that reductionist views do not explain how our experiences as of nowness, change and passage arise. As the passages from Williams, Skow and Hare bring out, the intuitive importance of accounting for our temporal experiences functions as the linchpin in the antireductionist case. The trouble for the reductionist is that she needs to provide an account of *why* (or how) we have such temporal experiences, instead of merely arguing that reductionist views should be adopted because they are ontologically, scientifically and semantically superior. Without explaining how we

could have such experiences, the reductionist can be dismissed by the antireductionist, who, with some intuitive justification, can claim that antireductionists are the only ones who can adequately explain why we have experiences as of nowness, passage and change.

I see the justice of this antireductionist reply. Moreover, there is something even stronger that the antireductionist can say. Noting that successfully perceiving or detecting motion is one of our most cognitively basic functions and is essential to our success as functioning agents in the world, he can extend this to the way we seem to perceive the motion of passage in order to justify his claim that we must really be detecting passage. Further, our conception of ourselves as beings caught in the ebb and flow of time is historically, aesthetically, linguistically and psychologically important to us, and so must be accommodated by any adequate philosophical account of time. So, in the absence of a reductionist account of temporal experience, the antireductionist can hold that we are perfectly justified in taking our experiences as of nowness and passage seriously enough to infer the real existence of nowness and passage. Spelled out this way, the antireductionist seems to be in a pretty good dialectical position.

We can summarize the antireductionist argument in the following way:

(1) We have experiences as of the nowness of events.

(2) We have experiences as of passage (and as of change).

(3) The thesis that there are temporal properties of nowness and passage provides the only reasonable explanation of why we have these experiences.

(4) The thesis that there are temporal properties of nowness and passage provides the best explanation of why we have these experiences.

(5) Hence, there are temporal properties of nowness and passage.

I will assume the truth of (1) and (2). In the absence of any reductionist explanation of (1) and (2), the antireductionist can defend (3) with ease. (4) follows from (3). (5) follows from an inference to the best explanation. The antireductionist may also argue that (4) is independently true because it follows from supplemental assumptions about the character of the antireductionist explanation, but I shall not explore that position here. My focus will be on undermining (3).

So I engage in the dispute on behalf of the reductionist. It is absolutely essential for reductionists to be able to provide an alternative, reasonable explanation of why we have temporal experiences as of nowness and passage. Without such an explanation, we cannot claim to have provided a theory of time that satisfies some of our most central intuitions about our ordinary experience. Moreover, we have no explanation to offer in place of the antireductionist explanation of the source of temporal experience, and hence no rebuttal to the inference to (4). So my concern in this paper is not to argue for reductionism in the usual ways, but to show how the reductionist can plausibly explain temporal experience, hence, to show why (3) is false. If the reductionist can show why (3) is false, she can then muster other arguments from science, language and metaphysics to undermine the plausibility of (4) and thus block the move to (5). So, if my argument below is sound, the most influential and plausible route to antireductionism is blocked. It also blocks the argument that only antireductionism has an adequate account of change (assuming that an adequate account of change requires an adequate account of passage).

I'll argue against (3) by providing an account of how temporal experience could arise from the way the brains of conscious beings experience and interpret cognitive inputs from series of static events. Once we have such an account, a reductionist ontology in conjunction with empirical results from cognitive science can be used to provide a reasonable explanation

of how we have experiences as of nowness, passage and change. The result, I hope, will be to change the dialectic by shifting the burden of proof. Since the linchpin of the antireductionist stance is that the reductionist has no reasonable explanation of the central features of temporal experience, my dialectical revision undermines the antireductionist. If the reductionist can provide a reasonable explanation of why we have temporal experiences with the qualitative character that we do, then the antireductionist will be forced to defend (4) and (5) on other grounds.

The place to start is with our temporal experience as of nowness. To make progress here, we must recognize the tight connection between the ontology suggested by temporal phenomenology and the ontology suggested by consciousness. There is an intimate connection between the subjective force of our experiences as of, say, redness and the subjective force of our experiences as of the nowness and passage of events. By extension, there is an intimate connection between the ontology necessary for our experiences as of redness and the ontology necessary for our experience as of nowness. (This extends to our experience as of passage, since it involves experience as of a succession of nows. But experience as of passage, because it also involves impressions as of motion and flow, will need additional special treatment—more on this later.)

The connection is a matter of how ontology supports the subjective *oomph* of experience. In other words, it is a matter of the ontology needed to make sense of the subjectivity of experience. The reductionist should argue that our experience as of nowness is simply part of the experience involved in being conscious, and that as long as we endorse enough ontology to make sense of the *oomph* of consciousness, we have enough ontology to make sense of the *oomph* of nowness.

So we need to think carefully about how the ontology needed for consciousness relates to the ontology needed for temporal experience. But first, we need to explicitly set aside an irrelevant asymmetry between the debate about consciousness and the debate about time. Here's the asymmetry: The debate over the ontology of consciousness has focused on the question of how to account for our phenomenal knowledge of experiences as of qualitative properties of objects, such as the redness of a tomato. The existence of the qualitative properties had by objects is usually not disputed (or, more carefully, the existence of some fundamental or manifest property of the object responsible for the relevant qualitative property ascribed to the object is not disputed), since the dispute centers on whether we need additional *distinctively mental* properties in order to account for the character of our experiences as of these qualitative properties of objects. This is not the dispute in debates over the status of properties of nowness or passage: we are concerned about whether events need to have certain temporal properties to explain temporal experience, not whether we need new distinctively mental properties to explain temporal experience. (We can see this by imagining the dispute between the reductionist and the antireductionist occurring between a pair of dualists. In other words, a pair of dualists could have opposing views about the ontology needed to support temporal experience.)

With the irrelevant asymmetry set aside, let's discuss the way the ontology needed to support the qualitative character of phenomenology is related to the ontology needed to support temporal experience. Recall that the antireductionist argues that we should infer the existence of nowness and passage from our temporal experience, and that real change requires passage. The claim trades on the idea that a reductionist theory of time cannot account for what the antireductionist argues we seem to perceive, namely, that present events have a special property, nowness, and that real change in events requires passage.

The antireductionist point is that there is a certain specialness to our experience that suggests the inference to the existence of special properties of nowness and passage. The claim is that the reductionist's parsimonious characterization of events in time gives us only a static world without nowness, change, or the "whoosh" of passage, and that we need more ontology to adequately capture reality. The antireductionist then claims that we need to include properties of nowness and n-adic properties (relations) of passage in our ontology. The similarity here to a dualist's approach in the philosophy of mind is striking. In each case, the claim is that reductionist characterizations of the world are somehow incomplete, and that to capture what it is like to have certain experiences, we must add special additional properties to our catalogue of what's in the world. And in each case, the move is faulty.[12]

The move by the antireductionist about temporal experience is faulty because it makes a fallacious inference from temporal phenomenological oomph to temporal ontological oomph. It fails to account for the possibility that a temporal experience is simply a part of a purely phenomenological experience, nothing more. But a temporal experience *is* just a part of an overall phenomenological experience, nothing more.

Let me amplify this. Consider our experience as of nowness. The reductionist can argue that the subjective character of our experience as of nowness is entirely encompassed by the subjective power of what-it's-like experiences.[13] When we have a phenomenological experience, such as an experience as of redness, there is a certain way it is like to have such an experience. (As my "as of" locution here suggests, I am not taking "experience as of

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[12] Callender, C. (2008). "The Common Now," *Philosophical Issues* 18, 339-61,
and Perry, J. (2001) "Time, Conciousness, and the Knowledge Argument," in *The Importance of Time*, ed. L. Nathan Oaklander. Dordrecht: Kluwer Academic Publishers compare the method made to support temporal ontological inferences to the method used to support dualist inferences motivated by the knowledge argument.

[13] The discussion in Le Poidevin, Robin. (2007) *The Images of Time: An Essay on Temporal Representation* (Oxford: Oxford University Press), ch. 5, supports this view.

redness" to mean that we are successfully seeing an instance of redness. Rather, I take it to mean that we are having a redness quale.) But when we have an experience as of seeing red, there is more to this experience than just experience as of redness, i.e. than just having a red quale. Along with having an experience as of redness, we also have an experience as of the *nowness* of the redness. We also have a nowness quale. In other words, when we have experiences as of redness, these experiences are not just as of redness *simpliciter*. They are experiences as of redness-now.[14]

This point generalizes across different sorts of qualia. The what-it's-like character of phenomenology has as much to do with temporal experience as it does with qualitative experience. All experiences combine the character of the qualitative experience caused by the relevant properties (for experiences as of different colors, let us assume we'd have different light reflectances as the different properties causing the qualitative experiences) with an experience as of nowness. The idea is that the what-it's-like of an experience contains within it the experience as of nowness along with further experience (for example, as of redness) What it is to have an experience as of nowness is part of what it is to have an experience *simpliciter*.

Let's try to be a little more precise about just what our sense as of nowness at each specious present reduces to (for simplicity, I'll just assume the duration of the specious present is just some nonzero t). For ease of exposition, assume that cognizers perdure as fusions of temporal stages. When we perceive the occurrence of an event, we have certain cognitive properties caused in us by the event. Individual *I*'s experience as of the nowness of an event at time *t* just *is I*'s having instances of such cognitive properties at *t*—in other words, it just *is I*'s having a phenomenal experience at *t*. The claim I'm making is that the

[14] And here or there, i.e., redness-here-now or redness-there-now.

subjective character of experience in general suffices for our experience as of the nowness of events. Different cognitive properties will result in the experiences having different qualitative characters, but each experience will include the same sense as of nowness. At each time that a stage of an individual exists with the relevant cognitive properties, the individual will have the experience as of nowness at that time—within that temporal stage.[15]

A slightly more complex version of this claim can be put this way: (i) (nontemporal) qualitative properties of events cause cognitive properties in us. (ii) At some time t_0, there is a (nontemporal) qualitative property *R* of event *E* that causes cognitive property instance *C* at t_1 in me. (iii) My having *C* at t_1 realizes my experience as of *R*ness-now at t_1. What is going on here is that the experience that is the having a neural state is more than just an experience as of a quality like redness, it is an experience as of nowness (and of thereness or hereness) as well.[16] With this analysis in hand, reductionists can explain the temporal experience as of nowness as (merely) a feature of consciousness.[17]

We can apply the explanation to a familiar case. Consider Prior's (1959) famous case of "thank goodness that's over."[18] I have a migraine beginning at noon that lasts for two hours. At 3pm, I say, "thank goodness that's over." Am I thankful that the event of having the migraine is past? Is the difference between what I experience at noon and what I experience at 3pm based on a difference between the headache being present and the

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[15] Callender's (2008) "The Common Now" in *Philosophical Issues* 18, 339-361, gives an interesting and plausible account of our "nowness" gestalt as a "present patches theory." Grünbaum, A. (1971). "The Meaning of Time," in *Basic Issues in the Philosophy of Time*, Eugene Freeman and Wilfrid Sellars (eds.), Open Court, 195-228, Savitt, S. (2002) "On Absolute Becoming and the Myth of Passage," in *Time, Reality, and Experience*, edited by Craig Callender, Cambridge University Press, and Sider, T. (2001). *Four-Dimensionalism* (Oxford: Oxford University Press), all include suggestions that our experience as of nowness is somehow related to consciousness.

[16] Of course, I'm not ruling out the possibility that merely locational properties of events are also causal contributors to the relevant cognitive properties.

[17] As Tyler Doggett noted to me (and as other detensers have sometimes noticed), we don't infer from our experience of "hereness" that there is some mind-independent property of hereness in addition to a property of having a particular location. So why do it with nowness?

[18] Prior, A. (1959) "Thank Goodness That's Over," *Philosophy* 34, 12-17.

headache being past? Prior says it is. He claims that the reductionist cannot explain the difference we detect, since for the reductionist, events at noon are on the same ontological footing at events at 3pm.

But if the special sense as of nowness we attach to events is just part of our conscious experience of such events, the flaw in Prior's thought experiment is exposed. At noon, I have the mental state of being in pain, and so I am conscious of the pain. At 3pm, I lack that mental state. The reason I say "thank goodness that's over" at 3pm is because my experience of being in pain is not located at 3pm, and so I do not have the pain quale at 3pm. I am thanking goodness at 3pm for the fact that I lack a certain cognitive property at that time. At 3pm, I have no conscious phenomenological state (apart from memories and the like) caused by the event at noon, but I do have conscious experience caused by events at 3pm.[19]

It's worth noting that my argument applies even if one is a dualist. I am a physicalist, so I assume dualism is false, and that the argument from the oomph of consciousness to the existence of special mental properties fails. But dualism furnishes just as much ontology as physicalism for the reductionist, for once we have accounted for the oomph of consciousness, whether it be by endorsing physical brain states or by endorsing irreducibly mental brain states, according to the reductionist, we have endorsed enough to account for the oomph of the now. We don't need an additional property of nowness on top of everything else.

Let's turn to the antireductionist argument for the ontological relation of passage. The heart of the antireductionist view of time is that passage is an ontological feature of the

[19] I'm glossing the fact that it takes a brief amount of time for an event to cause an experience in a subject.

spatiotemporal manifold, and that our experience of the world reflects our ability to detect this fact. Recall Williams' evocative description of how the antireductionist takes our experience as of passage to be an undeniable feature of our experience, and Maudlin's emphasis on "the manifest fact that the world is given to us as changing, and time as passing."

One problem is that it can be hard to figure out exactly what passage is supposed to be. As Taylor puts it "… passage, which seems to be such a basic and even necessary characteristic of reality, has always profoundly bewildered philosophers…" (279).[20] The reductionist needs to consider the idea of passage carefully and with as much clarity as possible in order to understand how to address antireductionist intuitions about its existence.

First, we'll need to try to be clear about what, exactly, passage is supposed to be. It might help to first be clear about how it is supposed to be necessary for change. What is common to all antireductionist accounts of passage is a heavy emphasis on the idea that some sort of passage, which we detect by detecting some sort of animated character or flow, is necessary for (real) change. Now, the question is, is passage simply change? If so, is it simply change of the sort we detect when we see a spinach leaf change from crisp to wilted?

Antireductionists usually take passage to be something more than the sort of change we see in the spinach leaf. The something more is what necessarily underlies the change of the leaf: events such as the event of the leaf being crisp passing out of the now (perhaps understood as this event passing out of existence, or at least as passing out of some sort of robust form of existence), and the event of the leaf being wilted coming into the now by

[20] Taylor, C. (2001, [1992]). "Time and Eternity," in M. Loux, *Metaphysics: Contemporary Readings*, Routledge, 279-288.

coming into existence (or by the event gaining some sort of more robust existence than it already had).

The antireductionist C.D. Broad liked to understand passage in terms of becoming. Becoming is probably best understood as the successive coming into nowness of events in the manifold at each successively present time. Those who endorse "pure" or "absolute" becoming as what passage fundamentally is will hold that even without qualitative change there is still passage.

Taylor (2001) has the clearest account of passage and its relation to change that I've found: "Let us use the expression "pure becoming" to designate the passage through time to which all things seem to be subjected, merely by virtue of their being in time. It is aptly called *pure* becoming because any other kind of change or becoming that anything might undergo *presupposes* this kind of change, whereas this pure becoming presupposes no other change at all. Thus, in order for anything to become red, or square, or larger, or weaker, or whatnot, it must pass through a certain amount of time, which is equivalent to saying that it must *become older*. The fact that something becomes older, however, or that it acquires a greater age than it had, does not entail that it undergoes any other change whatever." (281)

The question we must consider here is just how we are supposedly detecting or experiencing the fundamental physical fact of passage. What experience is it that underlies the antireductionist's reverence for the ontological posit of passage? The antireductionist seems to think that if we deny the existence of passage, by extension we deny a fundamental element of human experience. Hence, for him, the denial of passage borders on the absurd.

Let's look at this more closely. As I've noted, the antireductionist seems to take it for granted that we perceive passage. But what exactly do we perceive when we are supposed to be perceiving passage? How, exactly, does our temporal experience support the inference

that there is passage? The "received view" for the antireductionist seems to be that (i) we all have experience as of change (which can include experiences as of things beginning or ending their existence), that (ii) this experience as of change involves the detection of a certain sort of animated character or flow that really exists in the world, and that (iii) this detection allows us to infer that there is passage (or becoming). The inference to the existence of passage is the inference that there exists some sort of physical flow or ontological relation, i.e., passage, that we are detecting via our experience as of change such that this physical relation (i.e., passage) is the source of the character of the experience we are having. In sum, the antireductionist thought seems to be that we need to have passage in order to have the animation associated with "real" change, and that we need to have this sort of "real" change in order to account for our experience as of change.

We can certainly call to mind many examples where we have an experience as of motion or animation as part of our experience as of change. As the leaf turns from crisp to wilted or one's coffee cools from hot to lukewarm, we do seem to observe a change of properties in an animated way. But do we have experiences as of pure becoming independently of our experience as of change? Antireductionists are silent on this point. There is no claim (at least no claim I've been able to discover) that we somehow have experiences as of passage apart from experiences as of change, although, as we saw with Taylor, the antireductionist certainly infers that pure becoming is possible based on our experience as of change. The argument for the existence of passage relies solely on our experience as of change, rather than any claim that we somehow directly or independently detect passage as a fundamental feature of the universe.

What should the reductionist say in response? She definitely should not deny that we have experiences as of change. We do have such experiences. (Recall that by "experience as

of change" I merely describe an experience where we seem to detect a flowing or animated replacement of suitably intrinsic properties). She should also not deny there is real change, although she will define it differently from the antireductionist, since she will hold that real change is just the replacement of suitably intrinsic properties at successive times. In response to the antireductionist, the reductionist should deny the inference from our experience as of change to the existence of passage. To do this, she should explain how our experiences as of change could derive from our cognitive reaction to the successive replacement of properties—but in a universe without passage.

Let's explore how the reductionist can do this. What needs to be done is to give a plausible account of how our experience as of change could be a cognitive reaction to the successive replacement of suitably intrinsic properties (understood as the reductionist would have it, i.e., when *O* changes from *P* to *Q*, this is merely the successive replacement of suitably intrinsic properties). What needs to be done is to show how experience as of change does not require some sort of empirical detection of passage.

Perhaps the reductionist can explain our experience as of change as resulting from a kind of comparison we make from within. On this approach, we (mentally) step back and notice a contrast between the subjective experiences we had of events in the past and the subjective experience of more recent events, and this is responsible for our experience as of change and hence our experience as of passage. Put that way, it just can't be right.

Here's the philosophical problem with such an account (there may be empirical problems too). The four-dimensionalist understands events in time to exist as a series of temporal stages, with a stage located at each time. Individuals having experiences are parts of such stages: the (continuously persisting) individuals having experiences exist as a series of stages that are proper parts of the world-stage at every time. We cannot explain our

experiences as of change in terms of mentally stepping back and making a subjective comparison or marking a contrast between experiences had at earlier times and experiences had in the present because an experiencing stage cannot escape the stage that it is in. We cannot, as subjects, compare experiences in different stages because we cannot stand above or apart from our stages to make such a comparison, and we always have an experience at a time and hence within a stage. Experiencers are stage-bound.[21]

This relates back to the point made above that one's sense as of redness-now is a stagebound sense. How then, for the reductionist to explain our experience as of change? Perhaps we make "from within" a cognitive contrast between the subjective nature of memories we are having at that time and more "direct" subjective experiences we are having at that time. Russell suggests something like this in his account of time and temporal experience.[22] As long as such a contrast is within-stage it is philosophically possible for this to be the explanation, but it isn't particularly plausible. A surmountable worry is that it seems like we need to multiply subjective stances at time *t*: we have the subjective experience of the memory at *t*, the subjective experience caused by the event at *t*, and the subjective experience of the contrast at *t* between the other two subjective experiences. A more problematic worry (at least for me) is that we notice contrasts in our experience on a regular basis, for example, between differently shaded portions of a drawing, or between different locations of the red and green M&Ms scattered across the desk, yet such contrasts don't seem to suggest the

[21] The endurantist might have a slightly easier time with this problem, but I think it will get her in the end. The trouble is that even if an individual endures through each period of time, just as with perdurantism, she never steps outside of the temporal period she is in, and so she can't make the cross-time comparison that would be needed.
[22] Russell, B. (1915) "On the Experience of Time" *Monist* 25, 212-233.

sense of movement or flow that we have when we have experiences as of change.[23] Merely detecting a cognitive contrast isn't enough to cause our experience as of change.

No matter, for there is a much better way for the reductionist to use our detection of contrasts to make sense of our experiences as of change and passage. To prepare the ground for my account, I will first describe an interesting and empirically well-documented fact about our experience. The fact I'd like to describe is the illusion we have when, first, one small dot is shown on the left-hand side of a computer screen, and then, very quickly, that dot disappears and a small dot is shown on the right-hand side of a computer screen. Then the right-hand dot disappears and the left-hand dot appears, again and again, in rapid succession. Even when we are told that that what the computer is actually doing is merely blinking different dots on alternating sides of the screen, as long as the succession is rapid enough and close enough, *the effect is that we have the illusion of the dot moving back and forth across the screen*. This is what cognitive scientists used to call the phi-phenomenon, and what is now usually described as "apparent motion."[24] To get an intuitive sense of this experience, think of the way we experience the illusion of motion when we view a series of slightly different slides quickly, as in films, time-lapse photography or old-fashioned flip books. It's the very same phenomenon.

To the extent that other sensory modalities (such as our sense of touch) might give rise to similar phenomena there are similar results available. The cutaneous rabbit experiment documents how one seems to feel an object continuously hopping along one's arm with only a series of appropriately spaced taps (usually, three places are tapped: the wrist, close to the elbow, and the upper arm area, but the subject experiences the illusion of

[23] I'm indebted to Robin LePoidevin for this observation.
[24] Max Wertheimer. (1912) "Experimentelle Studien über das Sehen von Bewegung" Zeitschrift für Psychologie 61, 161-265.

the "hopping" moving up the arm, with the feeling of hopping occurring even between the taps).[25] One might argue that related auditory phenomena have been observed with spectral motion aftereffects with appropriate experiences of a Shepard scale, or with everyday experiences of listening to stereo.[26] However, I will focus on our visual experience, as visual stimuli seem to be the primary vehicle that sighted individuals use to detect change and motion.

The results about apparent motion are part of a wealth of data in cognitive science showing that the brain performs some sort of interpretative function when it processes sensory information it receives from relevant, appropriately located stimuli. Experimental results strongly suggest that some sort of sensory processing prior to the brain's representation of motion is responsible for our experience as of motion or change in these experiments. Another well-known case where we see the interpretative role of the brain in representing motion is with the "flash-lag" phenomenon, which involves visual effects derived from comparisons between the trajectory of a moving object juxtaposed with a brief presentation or the "flash" of a second object.[27]

So the psychological response that generates the illusion of apparent motion is well-documented and has been extensively analyzed. But with our case of apparent motion, how exactly does the brain process the inputs of the series <dot flash, left side>, <dot flash, right side>, <dot flash, left side>, <dot flash, right side>, etc? One model of how to understand the processing involves the brain somehow modifying the series of conscious experiences of

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[25] Geldard, F. and Sherrick, C. (1972). The Cutaneous "Rabbit": a perceptual illusion. *Science*, **178**(57): 178-9.

[26] I'm indebted to Daniel Dennett and the members of his Tufts reading group for the suggestion about stereo. A member of that group, Anselm Blumer, also suggested that auditory backwards masking might be another good example.

[27] Eagleman, D.M. & Sejnowski, T.J. (2000) "Motion integration and postdiction in visual awareness," *Science* 287(54-60). See Le Poidevin 2007 §5.5 for more discussion of our interpretation of phenomena and the brain's role in our experience of motion and the flash-lag phenomenon.

static left- and right-side flashes to give the impression of motion, and we somehow ignore (or erase) the experiences of the static flashes qua being static. But a second sort of model allows the input to the brain to be modified prior to any conscious experience, such that the only conscious experience is of the illusion of the motion of "the dot."[28] In the second sort of model there is no experience of a static dot that is somehow erased; rather, there is an input to the brain at one time, and then a second input at a slightly later time, and then the brain interacts with these inputs *prior* to producing a conscious experience.

Personally, I prefer the second sort of model (such a model can be made consistent either with Dennett and Kinbourne's "multiple drafts" model or, e.g., Velmans' integrationist model of consciousness), but this isn't essential for the use I want to make of the fact that we have this illusion.[29] I simply think the second model makes the overall story cleaner and more plausible because the second model itself is cleaner and more plausible. What really matters for what I want to say is just that it is an experimentally documented fact that we have the illusion of motion when presented with a series of appropriately related static images, and that our best cognitive science indicates that the brain plays an important interpretative role in representing the animated effects we experience (but not in any way that Russell envisioned). This is the fact I will use in giving an account of our experience as of change and passage, although I will also assume the pre-conscious model of how this happens.

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[28] Velmans, M. (1991) "Is Human Information Processing Conscious?" *Behavioral and Brain Sciences* 14, 651-726, and Velmans, M. (1992) "Is Consciousness Integrated?" *Behavioral and Brain Sciences* 15, 229-30.

[29] Dennett, D. and Kinsbourne, M. (1992). "Time and the Observer" Behavioral and Brain Sciences 15, 183-247.Velmans would say that the inputs are processed by the brain and then there is a single, integrated stream of consciousness or experience that results. Dennett and Kinsbourne would say only that the resulting representation is the product of the brain's interpretation or processing: there is only a "parallel stream of conflicting and continuously revised contents."

So fix in your mind what happens with our sample case of apparent motion created by the computer: our experience as of motion arises when the brain receives a series of inputs from an ordered set of events at closely located spatiotemporal positions, where the source of each input has a different spatiotemporal location from the one prior to it in the ordering. In the experiment, two things happen. First, the brain responds by somehow managing these inputs to give the impression that a persisting dot is moving back and forth between different spatiotemporal locations. Second, the brain's response also gives the impression that the change is continuous—that is, it gives the impression that the dot moves across the screen by moving smoothly and continuously from one side of the screen to the other. What seems to be creating this experience is that the brain needs to (pre-cognitively) manage some contrasting appearances: the brain receives an image of a dot with a spatiotemporal location, and then in the next moment it receives another image representing a qualitatively identical dot at a different spatiotemporal location quite close by, and in order for the brain to make sense of these contrasting facts it represents the images as a persisting dot moving from one location to the other. The illusion is also perceptually stable, in the sense that even when a subject knows she is merely seeing a series of discrete, unmoving images, she will still experience an illusion as of a persisting, moving dot.

The original experiment only compares changes in location. But when the *color* of the dot differs depending on which side of the screen an image flashes (say, red on the left and green on the right), the brain's response to these incompatible colors makes it seem as through there is still a single, persisting dot moving, but this single, persisting dot's color seems to *change* from red to green and back again (each color change seems to occur about halfway along its trajectory) as it moves back and forth across the screen. This is called the

"color phi" experiment.[30] Color phi is important for my view: when there are qualitative differences between the static images of the dots shown on the different sides of the screen, then the brain represents the situation as though there is an animated qualitative change in a dot from red to green—and this representation is as of an animated, qualitative, change, no different in character from other sorts of visual experiences as of change that we normally have as part of everyday experience. The take-home message here is that *the color phi experiment gives us the illusion of the animated character of qualitative color change.*

Really, the results of this experiment shouldn't surprise us if we have any knowledge of how films, television and video representations work. We constantly use these media to generate experiences as of change that are indistinguishable from our ordinary experiences as of change in our immediate surroundings (setting aside picture quality and other irrelevant issues). But the media work by presenting a succession of static images with only short temporal intervals between them. In other words, all they present to us is a series over time of static impressions with a certain amount of constancy of resemblance. Our brain then receives and interprets these inputs, representing certain types of constancy as persistence and successive contrasting properties as changes that have the animated, flowing character of our ordinary experiences as of change. For an excellent review of the psychological work on the ways we make representative sense of contrasts and constancies to construct impressions of objects persisting and changing over time, see Scholl (2007), especially §4, and for new work on the topic see Liverence and Scholl (under review).[31]

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[30] Kolers, P. and von Grünau, M., 1976, "Shape and color in apparent motion," *Vision Research* 16, 329-35. It was conducted at the suggestion of Nelson Goodman.

[31] Scholl, B. J. (2007). "Object persistence in philosophy and psychology." *Mind and Language*, 22(5), 563 – 91, and Liverence B. and Scholl, B. J. (under review). "Do we perceive events in time, or time in terms of events?"

This gives us the basis to explain our experience as of change and passage in the static universe of the four-dimensionalist. Recall that we are assuming that conscious experience is reducible to the having of neural states. In terms of this, the way to interpret the color phi case is that the illusion of animated color change occurs when the inputs <red dot flash, left side>, <green dot flash, right side> are manipulated by the brain to produce a neural state that (falsely) represents that there is a moving dot that is changing color as it moves. The phenomenal experience we have is as of a persisting dot moving while changing its color from red to green. Here, the qualitative character of the change we seem to experience is just as it would be if we were to see an actual color change of a persisting, moving dot.

How can the reductionist use this to provide an account of our experience as of change and passage? Recall the reductionist's theory of change: object *O*'s change from *P* at time t_1 to *Q* at time t_2 just reduces to *O*'s having suitably intrinsic property *P* at t_1 and *O*'s having suitably intrinsic property *Q* (instead of *P*) at t_2. Now recall the antireductionist objection: How can the reductionist, with only her static universe to draw on, accommodate experiences that seem to suggest that change requires more than (so-called) changeless facts? If all she admits into her temporal ontology are the stages of *O* being *P* at t_1 and *O* being *Q* at t_2, how can our experiences as of passage and change be accounted for?

The color phi experiment gives us the key. Remember what the cognitive science shows: when we have as inputs (1) the frame or slide of <red dot flash, left side> and then in close succession (2) the frame or slide <green dot flash, right side>, etc., we experience the illusion of motion and the illusion of an animated change of color in order to accommodate the contrasts between the slides.

Now think about our experience as of change in *O* from *P* at t_1 to *Q* at t_2 in just the same way: when we have this experience, the brain receives information from the temporal stage t_1 in which *O* is *P*, and then information from the subsequent temporal stage t_2 in which *O* is *Q*. The reductionist can hold that just as with cases of apparent motion (and with color phi in particular), we experience an illusory sense as of flow and change as the result of the brain's need to accommodate the contrasts between the stages t_1 and t_2.

How does this work? The idea is that, just as the cognitive science suggests, the brain processes the series of inputs and produces a mental representation or experience as of *O* changing in some suitably animated or flowing way from being *P* into being *Q*. More generally, when we have an experience as of passage, we can interpret this as an experience that is the result of the brain producing a neural state that represents inputs from earlier and later temporal stages and simply "fills in"[32] the representation of motion or of changes. So on this account, according to the reductionist, there is no real flow or animation in changes that occur across time. Rather, 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.

Do not claim that a direct perception of the flow of passage is what is responsible for our illusion of the flow of the apparent motion—this cannot be right. For increasing the spatiotemporal distance does not change the fact that there is passage (or would not change this fact, if passage actually existed): the images still occur in the same spatiotemporal order, and so would still pass in the relevant sense from the future into the present into the past. However, merely increasing the spatiotemporal distance between the images in this way causes the illusion of flow (and of flowing color change in the color phi test) to disappear:

[32] Not literally. It just gives the impression of being filled in. There is no "figment," as Dennett would say. For example, see Dennett, D. (1992). "Filling versus Finding Out: A ubiquitous confusion in cognitive science," in Pick, van den Broek, Knill (eds) *Cognition, Conception and Methodological Issues*, American Psychological Association.

Subjects just have experiences of a series of qualitatively different static images at different locations instead of a persisting object that appears to move and change (in a flowing sense) from red to green. The reductionist draws from this the conclusion that our experience as of flow in this case is simply a cognitive response to the spacing of the different causal inputs.

The reductionist can then argue that, if the brain can create the illusion of flow in cases of apparent motion, then it can create the illusion of flow in cases of experiences as of passage. In other words, the reductionist can use the experimental facts involving apparent motion, apparent change and apparent persistence to argue that, even though all she endorses is the existence of a static universe of a series of stages, this is sufficient for the brain to produce the illusion of motion and flow involved in the experience as of change. She can argue that, just as the series of frames of <red dot flash, left side> and <green dot flash, right side> are static inputs that create an experience as of change in color and an experience as of a persisting dot moving from the left side to the right, the series of temporal stages in which *O* is *P* and in which *O* is *Q* are static inputs that create an experience as of change from *O*'s being *P* at t_1 to *O*'s being *Q* at t_2. Saying it again, slightly differently: take frame one (temporal stage t_1) to be *O* having *P* at t_1. Frame two (temporal stage t_2) is *O* having *Q* at t_2. Frame three (temporal stage t_3) is the brain having the neural state caused by input from frames one and two. The reductionist can argue that the neural state at t_3 creates the experience in us as of *O*'s having *P* at t_1 and then changing in some "flowing" way to *O*'s having *Q* at t_2. In this way, the reductionist shows how it could be that the brain interprets the information it receives to give us experiences as of flow or animation, i.e., as of change and by extension, as of passage. Result: the reductionist's parsimonious ontology is sufficient to explain how we can have experiences as of change.

To take us back to a concrete case, think of how time-lapse photography works, and imagine watching a film of a seedling in the ground sprouting, then the bud slowly growing and, finally, bursting into bloom. The film is a series of stills, but our experience is as of watching a flower come into existence, with all the glory and animation suggested by Broad's and Taylor's ideas about becoming.

The representations that give us experiences as of change are also responsible for our sense of forward motion through time. Part of the intuitive basis for the antireductionist view about passage, as Williams described, is the subjective sense we have as of being selves moving through time or of moving into the future: "Here is the flood on which the oldster wakes in the night to shudder at its swollen black torrent cascading him into the abyss." An individual has an experience as of time's passing, one that the antireductionist might describe as a sense that one is moving into the future in virtue of experiencing the becoming of successive nownesses of events along the timeline.

This strong sense of forward temporal motion is part of what is explained by the reductionist as an illusion derived from successive qualitative inputs. Our sense of moving forward in time is an illusion that is a cognitive response to a series of qualitative inputs from a temporally ordered series of events, akin to the visceral sense of forward motion that one gets by sitting in a stationary train and looking out the window at another train moving backwards. (Just understand the cognitive input described as the "train moving backwards" as a series of inputs from appropriately spaced images with the right qualitative contrasts.)

This makes good reductionist sense. Just think about what it's like to watch an action movie or to have a virtual reality experience where the perspective of the viewer is located as though it were within a moving vehicle. When one has such an experience, all one literally has as cognitive inputs is a succession of static images, yet one can have the experience as of

moving spatially forward on a highway, or as of swerving right and left (in order to avoid the bullets of the bad guys). The reductionist argues that our cognitive management of and representation of a series of inputs is what gives us, in the same sort of way, the experience as of moving temporally forward or, conversely, the experience as of being stationary while events move towards us from the future.

So the reductionist explanation of our temporal experiences as of passage and change is that the brain manages contrasts between causal impressions of property instances it receives in quick succession in a way that creates these experiences. The brain responds to closely spaced inputs that have sufficient similarity (yet have qualitative contrasts of some sort) by accommodating and organizing the inputs. In doing so, our brains create the experiences we have as of change, and as of moving forward in time. As I described above, the claim that the brain does this is supported by work in experimental psychology.[33]

This understanding of the cognitive science suggests the following thought experiment: if we were in an entirely static environment where there were no contrasts between property instances (this would have to include no contrasts with respect to properties of my thoughts) then it would seem to us as though time were standing still. And, indeed, I think this is a very plausible supposition. We can even have such a sensation when there are contrasts in our environment that we could otherwise perceive but for some reason we are unable to attend to, such as when we are extremely shocked or surprised. If the brain does not have a suitable series of successive inputs involving contrasts it needs to manage (such contrasts can event include apparent differences in location, or existence at a location where nothing existed at the previous stage) then it need not resolve anything by representing a change. In such a case, the subject will have no experience as of change or as

[33] For a thoughtful and interesting discussion of the data on children's temporal experience, see chapter 6 of Alison Gopnik's (2009) *The Philosophical Baby* (New York, Farrar, Strauss & Giroux).

of passage. (This conclusion is supported by Liverence and Scholl (under review), who show that subjects' perception of discrete events determines their perception of the rate of passage.)[34] It is also important to remember that my account of how the brain constructs the experience as of passage is put forward merely as an empirical possibility that is suggested by the science: further work in psychology may confirm or disconfirm the account. As long as there is some plausible reductionist account of how the brain constructs experiences as of passage, the reductionist is vindicated.

The antireductionist may wish to object by arguing that the reductionist's account cannot really capture our experiences as of passage and change because the experiencer is stage-bound. The claim here is that we cannot transcend our stages, and so we cannot represent cross-time change and passage the way the reductionist wants to. It is a version of the objection to understanding our experience as of passage as resulting from standing back and making a subjective comparison between experiences. We might put the worry like this: If, for some subject *I*, each permanent, unchanging stage of *I* experiences its properties only within its stage, how can our experience as of passage and change be accounted for?

In the context of an explanation that attributes our sense of passage to representations created by the ways the brain pre-consciously manages certain sorts of

[34] There is a lot of work on the subjective perception (as) of the rate of passage. While there is still debate over the exact mechanisms behind the various ways subjects experience changes in how time seems to pass, it is abundantly clear that all sorts of factors affect subjective temporal experience as of passage, including the subjects' emotions, the amount of repetition and flickering of stimuli, and external environmental factors, and that brain processing is heavily involved in our experience as of passage. Eagleman, D.M. (2008), "Human Time Perception and its Illusions," *Current Opinion in Neurobiology* 18:131–36, describes the current physiological model as proposing that "the passage of time can be encoded in the evolving patterns of activity in neural networks" (p. 134). Another paper speculates that richer memories are somehow involved in our experience (as) of the slowing of passage (the speculation is based on data collected from bungee-jumping subjects along with the assumption that perceptual resolution would increase during such an experience). See Stetson, Fiesta and Eagleman (2007) "Does Time Really Slow Down during a Frightening Event?" PLoS ONE 2(12).

contrasts over time, this objection makes an important error. The error involves implicitly assuming that for one to have experiences as of change or passage, there is a need for some sort of cross-stage homunculus that can step outside the stages and watch changes occur. If there is no such homunculus (and of course there isn't), and if the individual at a time cannot step outside her stage, the error generates the worry about how an individual can compare cross-stage facts to have experiences as of change and passage.

To see the mistake here, look back at how we need to understand apparent motion. Recall that the brain pre-consciously manages successive inputs of <red dot flash, left side >, <green dot flash, right side >… to produce the conscious experience that is an illusion of flowing change in location and color. We know that the inputs in this case are two static "stages," not a single changing entity. Each input is an input of information from a static stage: input 1 at *t1* is <red dot flash, left side >, input 2 at *t2* is <green dot flash, right side >, and so on.

Here's the important bit of the reply to the objection. The best interpretation of what happens with apparent motion is that a stage of the brain collects static inputs of earlier stages and then a successor stage of the brain modifies them, producing a neural state in yet another stage that gives the subject (*I*) her experience as of passage and as of change. What is *not* happening is that a part of *I*'s brain is somehow acting like a homunculus, stepping apart from stages and interpreting a series of experiences to produce an experience as of passage and change. Rather, there is a stage of *I*'s brain that results from the causal inputs of the stages of <red dot flash, left side > at *t1* and <green dot flash, right side > at *t2*. A subsequent stage is the result of *I*'s brain having interacted with these inputs, a stage which realizes *I*'s experience as of a persisting, moving dot animatedly changing from being red into being green. So the first point is that the process is a series of causally connected frames

or stages. But the second point is crucial: we must remember that the representing entity need not be similar to what it represents. In other words, the neural state that represents the change, by realizing an experience as of change and passage, can itself be *static*. (Or, if one denies token-token identity, take the realized mental state to be a static event.) That is, the neural state creates the experience as of change and passage in us by representing things a certain way—and to do so, it need not change nor require the experiencer to step outside her stage.

I am sure that I have not accounted for every conceivable intuition about our experiences as of nowness, change and passage that the antireductionist can evince. But I believe I have shown how the reductionist can reasonably account for the main intuitions that antireductionists have deployed in support of their ontology. If the reductionist can provide a reasonable explanation of how we have experiences as of nowness, passage and change, she breaks the connection between temporal experience and temporal becoming, and by doing so works a deep change in the dialectic.

Recall the antireductionist argument:

(1) We have experiences as of the nowness of events.

(2) We have experiences as of passage (and as of change).

(3) The thesis that there are temporal properties of nowness and passage provides the only reasonable explanation of why we have these experiences.

(4) The thesis that there are temporal properties of nowness and passage provides the best explanation of why we have these experiences.

(5) Hence, there are temporal properties of nowness and passage.

If the reductionist account of how we have experiences as of nowness, passage and change provides a reasonable explanation of why we have these experiences, (3) is refuted. This immediately changes the dialectic: reductionists and antireductionists now need to argue over which explanation of temporal experience is the best explanation.

My own view is that, given the amount of support from cognitive science that the reductionist explanation enjoys, the explanation refutes (4) as well. Moreover, although I have not discussed them here, the refutation of (4) is bolstered by other reductionist arguments from metaphysics, philosophy of science and philosophy of language. But putting forward a fully developed argument against all ways of defending (4) requires a paper of its own, so I will not argue the case here.

I'll close with a discussion of how these experimental results suggest a number of further points that I find philosophically interesting. (A series of papers is in the works.) First, as I've discussed above, our experience as of change associated with motion can be an illusion in the sense that a series of static, ontologically distinct, images of similar instantaneous objects can create a response in us that is phenomenally identical to what it's like to see a persisting, changing, moving object. This gives us the interesting result that, for normal humans, there may be never be a phenomenal difference between our experience of a series of instantaneous objects that are appropriately spatiotemporally spaced and qualitatively similar, and our experience of a moving, changing, persisting object with the same qualitative and locational variation as the series.

A second point follows. An important ontological difference between a moving, persisting object and a series of instantaneous objects that are appropriately spaced is that the moving object persists while the objects in the series do not. But is there another ontological difference? In particular, does the motion of the persisting object actually involve

any sort of animated character across time? Does real motion, as opposed to merely apparent motion, really involve the sort of flow or animation we commonsensically ascribe to it? I think that if the animated character of our experience is illusory in the instantaneous case, there is no reason to suppose that it is any less illusory in the case where a persisting object is actually moving. Indeed, Occam's razor suggests that the flow or animated character we often refer to as "motion" is just a mistake. Motion is simply the change of location of a persisting object, and the flow or animated character we notice and identify with it is merely an effect of the brain. Recall the Kripkean distinction between heat and the sensation of heat: the distinction here is similar.

Hence, the apparent motion in our sample case where a computer blinks dots on alternating sides of its screen presents us with two illusions. The first illusion is as of motion, that is, as of a persisting object changing its location. (Motion requires persistence, but the dots are not causally related in a way suitable for persistence of a single dot, so our sense that we are seeing the motion of a dot is illusory.) The second illusion is as of flow or animated character, that is, of the animation arising from "the motion of the dot," which derives from the brain's need to pre-consciously accommodate certain kinds of contrasts of property instances. These illusions are different because motion is not flow.

Finally, these results have implications for work on the metaphysics of persistence. The two main ontological approaches to persistence are those of the perdurantist, who takes objects to persist as a series of appropriately related temporal stages of objects, and the endurantist, who holds that at least some of the objects in the world endure through time without perduring.[35] Endurantists often assume that their view is the more plausible one, since it reflects our experience of persisting objects as enduring through time and change.

[35] I am falsely assuming for the sake of simplicity that stage theory is classed as a variety of perdurantism.

Since the perdurantist takes persisting objects to persist only by having a bunch of appropriately related but numerically (and perhaps mereologically) distinct stages spread across time, she seems to be adopting a view that is harder to make consistent with our commonsense experiences. But perdurantists should take note: my discussion above suggests that, just as there is no argument from ordinary experience to nowness and passage, there is no argument from ordinary experience to endurantism.