Temporal Experience Workshop Report

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This report highlights and explores four questions that arose from the workshop on temporal experience at the University of Toronto, May 20th and 21st, 2013.

1. What can we learn about the nature of time from the nature of ordinary experience?

Physics attempts to give a complete, objective account of temporal reality, the "god's eye view of time." Many metaphysicians think that physics is the only source of empirical evidence we need to give an account of the fundamental nature of time. But some philosophers think that providing an adequate account will also require consideration of evidence drawn from ordinary experience. In her talk, Laurie Paul discussed two ways in which facts about ordinary experience might be thought to be relevant to metaphysical questions about time.

First, if ordinary experience presents us with features of temporal reality that are not adequately captured by the account of time that we get from fundamental physics, then that might give us a reason to augment that account. Paul considered an argument offered by Tim Maudlin (2002) and others that our ordinary experiences as of passage and change license positing a metaphysically fundamental "temporal arrow" not posited by contemporary physical theory. According to the argument, ordinary experience presents the world as containing such a temporal arrow, and this gives us a reason to believe that there really is such an arrow.

In response, Paul first noted that such a view assumes that ordinary experience reveals the fundamental nature of reality to us directly. She then argued that there is no good reason to accept this assumption. First, she observed that it is unclear what plausible epistemological story might underwrite such an assumption. (Should we think, she asked, that we have a special

perceptual faculty that somehow lets us directly perceive the fundamental structure of reality?) Second, she argued that we could provide a satisfactory explanation of why ordinary experiences present the world as containing a temporal arrow without modifying the account of time that we get from physics. Cognitive science and psychology, she argued, have shown that ordinary experiences are "highly constructed." That is, how the world perceptually appears to us is in large part the result of the assumptions our perceptual systems make about the external environment. (This point about perception was emphasized by two other conference participants in their talks, Alan Johnston and Josh Tenenbaum.) The perceptual appearance of a temporal arrow, then, can plausibly be explained away as a mere byproduct of the way our perceptual systems construct our experiences.

Those who agree with Paul debate over how a subjective perspective may be integrated. "Inflationists" postulate fundamental metaphysical properties to explain the temporal features in question (for such a view about passage, see Craig (1998), and Schlesinger (1982), among others). On these views, a primitive directional property grounds the inherent directionality of time (Maudlin 2002). Others, like Paul, think that such non-reductivist positions rely too heavily on the assumption that the phenomenal features of our veridical perceptual experiences intrinsically match the features of the world. Paul rejects such an assumption, arguing that there is sufficient empirical evidence to show that experience is highly constructed. Paul herself is a reductivist, albeit one that aims to integrate the subjective perspective by looking at cognitive science to understand better the nature of experience.

Those who disagree with Paul fall into two camps. "Eliminativists" deny that there is anything to explain: if science is correct, then time, *as we experience it*, is an illusion (for such a view about passage, see Williams (1951), Mellor (1998), and Le Poidevin (2007), among others).

‘Minimalists’ deny that there are any features of time which are not reducible to those determined by science. According to one such theory, the direction of time is reducible to the global entropy gradient (see Lewis (1979), and Sklar (1985), among others). That is, the direction of time is fully explained by the fact that entropy increases towards the future.

We said that Paul discussed two ways in which facts about ordinary experience might be thought to be relevant to metaphysical questions about time. A second way is as follows. Even if explaining the appearance of a temporal arrow in the external world does not require positing the existence of a metaphysical fundamental temporal arrow, perhaps explaining the way our experiences themselves seem to us to change will require augmenting the account of time that we get from contemporary physics. Ordinary experiences are a dynamic feature of reality in their own right, and perhaps explaining their subjective character (which contemporary physics does not purport to explain) will ultimately require accepting the claim that the world contains a metaphysically fundamental temporal arrow—a *subjective* temporal arrow.

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2. What is the relationship between time as represented in experience, the timing of the experiential act, and the timing of the neural realizer of the experience?

Perceptual experience seems to represent time in a variety of ways. We seem to be perceptually aware of certain temporal properties of things such as durations, simultaneity, and succession, as well as the sensible properties of temporally extended events such as movements, color changes, or melodies.

The first question one might ask is whether such qualities really are represented in perceptual experience, or whether they are only represented downstream of experience, in perceptual beliefs or other cognitive states. Anti-realists about temporal experience take the latter option and claim that experience is a matter of undergoing a succession of "snapshots", each of which only represents non-temporal features (see Chuard 2011 for a recent defense). Realists, on the other hand, accept the view that perceptual experiences themselves represent temporal properties. Two main realist models of temporal experience can be distinguished, depending on how they view the relationship between temporal properties represented in experience and the timing of experiences themselves (i.e., the vehicles or "acts" of experience).

Extensionalists maintain that experiences do not only represent temporally extended events, but are themselves temporally extended, and that there is an explanatory relationship between these two facts. Minimally, the claim is that the temporal extension of the experience is a necessary condition of the possibility of representing temporally extended properties.

Typically, it is further claimed that the temporal structure of experience matches the apparent temporal structure of the objects of experience, such that, for instance, whenever an experience apparently presents us with an event of a certain duration, the experience itself persists for a matching amount of time (see e.g. Phillips, forthcoming).

Retentionalist models, on the other hand, reject such claims. These models have often been taken to involve the assumption that, while representing temporally extended events, experiences are themselves strictly momentary events. However, it is open to retentionalists to accept the (empirically plausible) assumption that experiences are extended, while denying that there is an explanatory dependence between the temporal extension of the experience and that of the events represented in experience of the sort maintained by extensionalists.

How could one adjudicate between these two models? Some (e.g. Dainton, 2000) argue for a variety of extensionalism on the basis of broadly phenomenological considerations. But this raises a methodological worry: how can one argue for claims about the relationship between the structure of the vehicles of experience and their contents based on the deliverances of introspection?

Others (e.g. Lee, forthcoming) claim that empirical considerations about how temporal information is processed by the neural realizers of experiences should decide the matter. In his talk, Lee argued that if one is a physicalist about consciousness, one should accept the principle that the timing of experience is identical to the timing of its neural realizers; and that since there is incontrovertible evidence for the temporal extension of the realizers of experience, the only plausible view seems to be that experiences are extended, as well. In Lee (forthcoming), he further argues that this does not entail extensionalism, since there is evidence that suggests that

the neural realizers of experience represent temporal properties not by structural resemblance, but in a quasi-simultaneous way.

However, Lee's approach raises a methodological worry as well: how do we know that we have detected the neural realizer of an experience rather than the causal antecedents or consequences of this realizer? Suppose, for instance, that experiences were, in fact, instantaneously realized. This is prima facie compatible with the observation of temporally extended neural events in the causal ancestry of the experience.

Correspondingly, the observation of a quasi-simultaneous representation of temporal properties is compatible with extensionalism if it can be maintained that this representation happens downstream of perceptual experience. Any theorist who wants to argue for a particular temporal shape of experience on the basis of empirical considerations involving the neural events that occur (roughly) simultaneously to the experience needs to give further reasons to prefer one of these options.

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3. What sorts of mechanisms underlie the perceived duration of external events?

A growing body of empirical evidence suggests that the various functions one might intuitively lump together under the heading "temporal experience"—judgments of simultaneity, duration, flicker rate, order, and others—are carried out by different mechanisms (Bayne et al., 2009: 629). We can then ask: How do these mechanisms, in particular those that underlie perceived duration, work?

According to the relatively standard pacemaker model, one part of the brain ticks in the manner of a pacemaker, while another part counts the ticks. An event's perceived duration is a function of the number of ticks counted since its perceived onset. This model accounts for various duration illusions, such as the familiar experience of its appearing that perceived events have slowed down when one is afraid, in terms of a speeding up or slowing down of the pacemaker's ticking.

But in his talk Ian Philips observed that the pacemaker model doesn't provide a plausible answer to the question why the clock speeds up when we're afraid. Philips suggests that what speeds up when we're afraid is not the ticking of an internal clock, but the rate of our mental activity (which *is* readily explicable in terms of its adaptiveness). He then argues that when we're afraid the perceived duration of events is modified because the perceived duration or external events is (or can be) determined *relative* to the perceived rate of our mental activity, so that if more is going on than usual in the mind's eye, it might seem to one as though things outside the mind are going more slowly than usual. Lodging an objection like that which Philips raised against the simple pacemaker view, though, Geoff Lee observed that the correlation between the rate of our mental activity and the perceived duration of external events might in turn be explained by their having a common cause, namely, an increase in brain activity generally.

Carla Merino-Rajme opts in her talk for a *subjective* pacemaker model of perceived duration, according to which chunks of the external world experienced as a temporal unity, or *quanta*, are themselves the ticks which, if attended to, contribute to an impression of their numerosity (or, are "counted"). The individual quanta are in turn bound phenomenologically to this impression of their numerosity: each is felt as a member of a series of quanta of a certain duration. Merino-Rajme argues that one of the advantages of this model over the standard pacemaker model is phenomenological: it explicitly incorporates a phenomenological relation between experiences of short-term durations (quanta) and experiences of long-term durations, or series of quanta.

Rather than making perceived duration a function of internal ticking, Alan Johnston proposes that the perceived duration of external events is determined by a content-contingent "pathway" or "mechanism." Having conducted experiments in which he was able selectively to modify the perceived duration of events occurring in highly spatially specific areas of the visual field (to the exclusion of other areas), Johnston argues that rather than a central clock model we need a central decision procedure by means of which we can come to (a limited number of) temporal judgments on the basis of prediction and evidence from the various senses.

The theme of prediction, or of expectation, was also picked up in discussion of the oscillator model, defended by Diana Raffman (see Drake, Jones, and Baruch, 2000). According to this model, our ability to discern temporal features such as the relative durations of diverse aspects of complex stimuli (such as musical stimuli) is to be explained in terms of our brain's having oscillators suited to becoming "entrained" to different sorts of temporal patterns. This entrainment generates predictions that can then be compared to a reference oscillator. Although the pacemaker model has some advantages over the central clock model, the clock model was

thought to provide a more straightforward mapping between durations and the way they're represented in experience than the oscillator model.

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4. Do we have one central clock for time, or different clocks for each sense modality?

At the workshop, participants gave prima facie reasons both for the view that humans have one central clock for time, and for the view that each person has multiple clocks. One reason given for thinking that there is a central clock is that we can match-up temporal information in different modalities fairly easily, which suggests a common metric, and a common counter. On the other hand, one reason given for the claim that there are different clocks is that time is often distorted differentially. Consider the multi-modal oddball effect, for instance. In the standard (unimodal) oddball effect, a novel stimulus is inserted into the middle of several tokens of the same type stimulus. This makes the novel stimulus appear longer. In the multi-modal oddball effect, introducing an auditory stimulus at the same time as a visual oddball can modulate the duration of the visual stimulus, but introducing a visual stimulus at the same time as an auditory oddball does not modulate the duration of the auditory oddball (Chen and Yeh, 2009). On its face, one of these cases seems to involve a distortion in one modality but not the other, implying a different clock for each modality.

In the workshop, some speakers thought that the two options (one central clock, or several different clocks) were not mutually exclusive. In particular, they thought that there could be differential temporal distortions that fed into one centralized clock. In Ian Phillips' talk, for instance, he argued that the relative duration of mental activity is used as a standard for making judgments about the absolute duration of other events. This sounds like a central clock model. Since there's only one unit of measurement, which is mental activity, it seems like the view wouldn't allow that time dilation could happen in one modality but not in another. However, Phillips argued his view did not preclude modality-specific temporal distortions. This is because such distortions could be determined quite independently of the mental activity, by mechanisms that are below the level of anything that conscious experience could tell you about them. In the multi-modal oddball effect, for instance, it could be that the effect has to do with perceptual attention, and that mental activity has nothing to do with it. This would be a problem for Phillips' view only if the sole mechanism determining durations was how much mental activity there was, a view that he rejected.

In his session, Alan Johnston also tried to make differential temporal distortions consistent with a central clock model. He presented evidence for temporal distortions in different spatial regions, rather than in different sense modalities. In one study (Johnston, Arnold, and Nishida, 2006), subjects were asked to look at a fixed central point, while a sine grating drifting at 20 Hz was placed either to the left or the right. In the next phase of the experiment, gratings drifting at 10 Hz appeared on both sides of the fixed focal points. The result was that subjects perceived the grating located on the same side of the first sine grating as lasting a shorter time. This might seem to indicate that there are many different clocks, perhaps even one for every spatial region. However, Johnston rejected this conclusion. On his view, it is not that there are

clocks at every position in space, but that there are adaptable mechanisms at every position in space that can alter your perception of an event with regard to how long it occurred for. Furthermore, he offered a reason for thinking that there is a central clock: you can match-up temporal information in different modalities fairly easily, which suggests a common metric, and perhaps even a common counter.

In his talk, Mohan Matthen gave an argument that there is a single representation of time common to all modalities. Among other things, he pointed to the common experience of watching television and having the audio lag behind the visual. While the perceptual system does not synchronize long lags, it does synchronize short ones. Matthen took this synchronization as evidence that the brain works to figure out the temporal structure of the events we perceive. Perceptual experience represents events as happening "now," i.e. at the time of the experience. But the brain receives information about these events in different order. The brain then works to figure out the temporal structure of the events we perceive (across sense modalities), as time gets imposed on perceptual experience by sub-personal cognitive processes.

In the final panel discussion, Susanna Siegel introduced a related, but remaining question. Her question concerned the specious present, an extended temporal duration of which we are aware of at any given instant. In particular, she asked whether the specious present lasts different times in different modalities. Do the units that constitute the specious present amoral, or are they modality specific? This is a question that was left unanswered from the workshop.

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