

Experience of and in Time

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Abstract

How must experience *of* time be structured *in* time? In particular, does the following principle, which I will call *inheritance*, hold: for any temporal property apparently presented in perceptual experience, experience itself has that same temporal property. For instance, if I hear Paul McCartney singing 'Hey Jude', must my auditory experience of the 'Hey' *itself* precede my auditory experience of the 'Jude', or can the temporal order of these experiences come apart from the order the words are experienced as having? A number of recent authors (Phillips *Experience and Time*, 'The Temporal Structure of Experience', Soteriou 'Perceiving Events', Hoerl "A Succession of Feelings, in and of Itself, is Not a Feeling of Succession", Rashbrook) claim, to paraphrase Martin (399), that inheritance best characterises how our temporal experience seems to initial reflective intuition. For this reason, Phillips takes the principle to form part of our naïve view of temporal experience. An opposing group of theorists object that inheritance is subject to empirical counter-example. This article surveys such challenges. Section 2 considers Grush's case against inheritance based on postdiction. Section 3 examines Watzl's anti-inheritance argument based on silencing effects. Finally, Section 4 explores a number of alleged counter-examples proposed by Lee ('Temporal Experience and the Temporal Structure of Experience'). Section 1 provides essential background to the debate.

1. Background

The briefest reflection reveals that temporal properties – simultaneity, succession, order and duration – are manifest throughout perceptual experience.¹ Yet, philosophers have been puzzled by this seemingly obvious truth – so puzzled that some have felt compelled to deny it. Recently, for example, Chuard argues that we cannot 'perceive temporal relations between non-simultaneous events' (3). In this, he joins a significant strand of scepticism, which traces back at least to Reid's notorious claim that 'no kind of succession can be an object either of the senses or of consciousness ... and on that account, the motion of a body, which is a successive change of place, could not be observed by the senses alone without the aid of memory' (270; also Prichard). Here, I set such scepticism aside.² Instead, I focus on a recent debate both sides to which accept the 'phenomenological constraint' (Dainton *Stream of Consciousness* 115) that we are capable of experiencing temporal relations between non-successive events. This debate concerns the *way* in which we experience temporal phenomena, and in particular the relationship between the objects or contents of our temporal experience on the one hand, and our experience itself on the other.

On one side of this debate are theorists who take temporal awareness to be a special case of perception in which our experience itself inherits the properties apparently presented in experience. In general, we do not think that such inheritance occurs. It is no part of the manifest image that a subject who seems to see a red square undergoes an experience which is itself 'qualified by redness and squareness' (Robinson 183). Indeed, it is tempting to hold that such an inheritance claim for colour or shape involves a category error. The case of

temporal properties is different. Experience is a process and, as such, unfolds in time with its parts standing in temporal relations to one another. Temporal inheritance is then a real possibility. Is it an actuality?

According to several recent authors, we have reason to believe inheritance based on reflection on our experience. In this way, inheritance is a *further* phenomenological constraint on theories of temporal experience. Phillips (*Experience and Time*, ‘Perceiving Temporal Properties’, ‘The Temporal Structure of Experience’) and Soteriou (‘Perceiving Events’, ‘The Perception of Absence, Space, and Time’) express the idea in terms of the *transparency* of temporal experience. This claim can be broken down into two components. Firstly, there is the claim that when we set-out to describe our experience itself, we find ourselves doing so, at least partly, by attending to its objects. And what we find of current relevance is that there are objects of attention which we cannot attend to without attending to goings on *over* a period of time. Arguably, this is true of all objects of attention. But it is certainly true of some, such as sounds or movements. Here, as Soteriou (‘Perceiving Events’ 226) puts it, ‘If one tries just to attend to an instantaneous temporal part of the occurrence, without attending to a temporal part of the occurrence that has a temporal extension, then one will fail.’ He adds, ‘Instantaneous events may also feature in the conscious character of experience (e.g. the event of an object starting to move), but when they do, it seems to one as though one cannot attend to them without thereby attending to something that has temporal extension (e.g. the object moving).’

Reidian sceptics may dispute this first transparency datum. Parties to the present debate will likely accept it. It is the second transparency claim which only some find compelling. This is the claim that it seems to us that our experience itself unfolds alongside, and in step with, the temporal phenomena which we find ourselves attending to in reflecting on our experience.³ As Phillips puts it: ‘in good cases, we ‘take in’ the temporal structure of the events we witness in witnessing them. In bad, i.e. illusory, cases, it is as if this is so’ (‘The Temporal Structure of Experience’). Soteriou suggests that this connects to ‘a distinctive respect in which perception seems to one to be passive and not subject to the will’ (‘Perceiving Events’ 227), contrasting the case of episodic memory (and presumably imagination) where we seem plainly to be able to distinguish the time and duration of our act of remembering and the time and duration of the event(s) remembered (see also Rashbrook §2).

This putative datum, under various guises, arguably plays a fundamental role in debates about temporal experience from Reid through the seminal contributions of James, Broad, Brentano and Husserl to the present. (This way of conceiving the dialectic is defended at length in Phillips *Our Experience of Time*, see also the discussion of *The Principle of Presentational Concurrence* in Miller.) The principle I focus on in sequel I call *inheritance*, the claim that for any temporal property apparently presented in experience, our experience itself possesses that temporal property. Against this formulation, it might be objected (see Chuard 10–11) that the transparency datum could only reasonably be the claim that our experience *seems* to inherit the temporal characteristics of its apparent objects and not the claim that it in fact does. However, in the relevant sense of seeming, it is doubtful that we can really make sense of a gap between how our experience seems and how it is.⁴ Moreover, even if we do allow for such a gap, only hardened sceptics will resist the thought that our experience’s seeming a certain way favours a theory which respects those appearances.

Those who reject inheritance typically deny that our experience seems to unfold in step with its objects. This is sometimes because they deny that we have *any* introspective knowledge of the temporal structure of our experience, occasionally accusing the opposing viewpoint of an embarrassing vehicle/content confusion (e.g. Tye, Lee ‘Consciousness in a Space-Time World’ 343; on these accusations, see Phillips ‘The Temporal Structure of

Experience' §§5–6). Such a denial is compatible with our being irremediably ignorant of the relationship between the temporal structure of experience and that of its objects. Nonetheless, most critics argue positively against inheritance. Before turning to those arguments, a number of clarificatory points need noting.

First, whilst inheritance is commonly associated with what Dainton calls 'extensionalist' models of temporal experience, according to which 'our episodes of experiencing are themselves temporally extended, and are thus able to incorporate change and persistence in a quite straightforward way' ('Temporal Consciousness' §1.1), the association is not obligatory. Certainly, the two leading extensionalists, Foster and Dainton, both seemingly endorse forms of inheritance.⁵ Moreover, as Dainton sets the issues up, the primary opposition to extensionalism is the retentionalist view that 'our experience of change and succession occurs within episodes of consciousness which themselves lack temporal extension, but whose contents present (or represent) temporally extended intervals' ('Temporal Consciousness' §1.1). And, as is plain from this characterization, retentionalists reject inheritance since, for them, we experience intervals at instants. Nonetheless, simply thinking that experience is essentially extended in time does not commit one to inheritance, nor vice-versa. One could accept that experience was extended in time but deny that its temporal structure was inherited from its objects. And one could, as Reid apparently does in arguing for his scepticism about temporal experience, combine inheritance with the view that experience is not extended but 'confined to the present point of time' (270). More generally, the fundamental question of how experience of time must be structured *in* time is not perspicuously answered in terms of whether experience is extended or not. As Dainton would surely agree, an experience consisting of a series of logically independent snapshots would be incapable of incorporating change and persistence; yet it is unclear why we should deny that such an experience has extension in virtue of having distinct parts at distinct times. Given this, although I briefly return to extensionalism at the end of the next section, my primary focus is on inheritance.⁶

Second, inheritance is entirely compatible with the (undoubted) existence of temporal illusions. According to inheritance, our experience mirrors the *apparent* temporal structure of the world presented. For an illusion to constitute a counterexample, it would have to be a very particular kind of illusion, namely, one where we were apparently presented with a temporal property *whilst our experience itself lacked that property*. Whether such cases exist is precisely in question below.

Third, the inheritance principle insists only on a one-way mirroring between experience and its apparent objects. The claim is *not* that the temporal properties of experience are all and only those apparently presented in experience. Consider cases where an object changes very slowly, as when the hour-hand moves imperceptibly around the clock-face. If we stare at the hour-hand for a minute or two, we will see the hand in a discriminably different position, and so our experience of it will have changed. But we will not have seen it moving. In other words, a change in experience is insufficient for us to experience change. A defender of inheritance should agree. They should insist only that changing experience is *necessary* for us to experience change. Here compare the traditional claim that 'a succession of feelings, in and of itself, is not a feeling of succession' (James 629), discussed in Hoerl "'A Succession of Feelings, in and of Itself, is Not a Feeling of Succession'" and Rashbrook.

Fourth, though it is very natural to think of motion and change as temporal properties since they bear a logical connection to time, it is important to note that they are not strictly speaking within the extension of 'temporal properties' in the formulation of inheritance above. Given the logical connection between change and succession, inheritance arguably entails that any experience of change involves change in experience. But when we perceive

a *particular* form of change, such as motion or change of colour, it is neither plausible to think, nor any commitment of inheritance, that our experience itself *moves*, or changes *colour*.

Fifth, and finally, one might worry that inheritance presupposed a contentious ontology of experience. As an anonymous reviewer pressed the concern, if I hear a fast *glissando*, does inheritance require that my experience consist in a series of very short-lived auditory experiences, and is this not a contentious form of atomism? Providing a satisfactory ontology of experience and experiences is a topic well beyond the scope of this article.⁷ However, given the formulation of inheritance, there is no reason to think that any implausible ontological commitments will be incurred. First, as already emphasised, inheritance is a one-way thesis: it attributes to experience the apparent temporal structure of its objects. Thus, inheritance creates no danger of experience itself being attributed a structure which outstrips our discriminatory capacities. Second, as briefly explored in the next section, we should be live to the idea that there are logical inter-connections between successive phases of experience, and in particular that our experience at a time, may be dependent on our experience over a significant stretch of time. Given these possibilities, the proposed postulation of very brief experiential phases does not obviously involve any contentious form of atomism.⁸

I now turn to putative counterexamples to inheritance. I first consider postdiction. In §3, I turn to silencing effects. Finally, in §4, I turn to a series of examples raised by Lee. In each case, I briefly explore how defenders of inheritance might respond.

2. Postdiction and Inheritance

The term ‘postdiction’ was coined by Eagleman and Sejnowski (‘Motion Integration and Postdiction in Visual Awareness’) for cases where perceptual experience of an initial, target stimulus is altered or eliminated by a second, modulator stimulus, even though that second stimulus is presented after the initial stimulus is offset. Dennett and Kinsbourne, and Dennett first urged that such cases undercut certain naïve assumptions about the temporal structure of our experience. Here, I focus on a narrower postdiction-based critique of inheritance due to Grush.⁹

Grush focuses on a postdictive effect called the cutaneous rabbit illusion (Geldard and Sherrick). He also mentions apparent motion (Wertheimer, Kolars and von Grünau, Eagleman and Sejnowski ‘The line-motion illusion can be reversed by motion signals after the line disappears’). However, he might have chosen any of a wide-range of such effects, including backwards masking (Alpern; Enns and Di Lollo), sound-induced visual bounce (Sekuler, Sekuler, and Lau) and the flash-lag illusion (Mackay; Nijhawan, Eagleman and Sejnowski ‘Motion Integration and Postdiction in Visual Awareness’). Plausibly, such effects reveal a mechanism at work throughout perceptual experience (Choi and Scholl).

In the cutaneous rabbit illusion, fifteen 2 ms pulses are delivered to a subject’s arm in rapid succession (the effect is optimal with 40–60 ms gaps): five at the wrist, five 10 cm towards the elbow and finally five 20 cm towards the elbow. A subject receiving only the first five pulses will accurately experience them all at the wrist. However, if they receive all fifteen pulses, the pulses will ‘seem to be distributed, with more or less uniform spacing’ from wrist up the forearm (Geldard and Sherrick 178), as if a rabbit were hopping along it. Strikingly, then, whether pulses two through five are felt (accurately) to be at the wrist or (inaccurately) to be shifted up the arm depends on the occurrence and location of later pulses. Focus just on the second pulse felt either at the wrist or a little way further up the arm. What is felt very shortly after this pulse has been delivered but before a sixth pulse has been delivered (around 200 ms later in optimal conditions)? We seem to have two options. Either the pulse is

(accurately) experienced at the wrist. In which case, if later pulses are delivered and the subject experiences the rabbit effect, this earlier experience must somehow be overwritten. Or the subject's experience of the pulse must be delayed at least 200 ms (on the editing floor of the brain, as it were) until its apparent location is settled in light of the presence or absence of a sixth pulse.

Grush's 'trajectory estimation model' embraces the first option. As he puts it, whereas '*at the time of the second impulse*, the subject perceives it to be at the wrist; at the time of the (sixth) impulse, the subject has no recollection of this prior interpretation and rather has a perceptual state to the effect that there is currently a sequence of impulses; the second of which was just proximal to the wrist' (39, his emphasis). In short, the rabbit effect involves a subject very rapidly forgetting an initial, accurate experience of wrist pulses, and subsequently enjoying an illusory experience of pulses further up the arm. This model is plainly inconsistent with inheritance. The experience had at the time of the sixth impulse is very short-lived on Grush's model – it might even be instantaneous – but it nonetheless presents a period of time which includes an extended sequence of impulses.

If Grush's model were strongly to be preferred over rivals, then inheritance would be imperilled. However, as noted, there is another obvious interpretation of postdiction which Grush neglects. On this model, our experience of the location of pulse-events is subject to a delay of a few hundred milliseconds, enough time for neural processing to take into account immediately subsequent input, and so potentially to adjust the initial representation of the pulse location ahead of conscious experience. Just such a model is adopted by Dainton ('Sensing Change' 381–2). It is wholly consistent with inheritance.

As Dainton is clear, deciding between these models is an empirical question. However, great care is needed in interpreting empirical data. This is nicely illustrated by considering findings due to Lachter, Durgin and Washington concerning backwards masking.¹⁰ Lachter, Durgin and Washington studied a metacontrast paradigm in which stimuli similar to those in Figure 1 below were presented in rapid succession. What they found was that 'the ability of subjects to distinguish such a disc/ring pair from [ring/ring pair is dependent [not only on the delay between the onsets of disc and ring but] also on how soon after the stimulus they respond' (269). Forced to make speeded responses, subjects were much better at discriminating disc/ring pairs from ring/ring pairs than when allowed to respond at leisure.

Lachter, Durgin and Washington claim that these 'data support those [like Grush] who believe that these phenomena point to a kind of amnesia, a failure to remember the earlier stimuli, rather than a kind of blindness' (274). However, this conclusion is over hasty as the authors themselves later acknowledge (277). One reason is that it is highly disputed

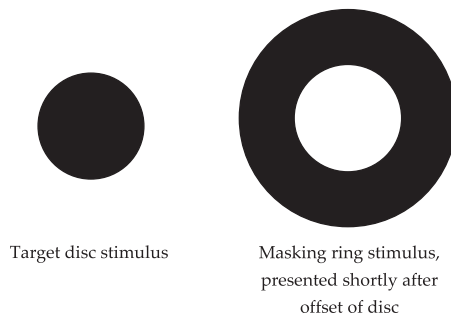


Fig. 1. Classic metacontrast stimuli, similar to those used in Lachter, Durgin and Washington.

whether speeded two-alternative forced-choice procedures accurately reflect the contents of consciousness, as opposed to tapping non-consciousness or *pre-conscious* information, information which is significantly processed but off-stage of consciousness. Given this, a delay theorist can interpret Lachter, Durgin and Washington's findings in terms of automatic response routines guided by pre-conscious representations that, in the presence of a mask, fail to reach conscious experience. As a result, the relevant data do not decisively favour Grush's amnesia model over Dainton's inheritance friendly delay model.

The kind of delay required to accommodate the full range of postdictive effects is at least several times the 50–100 ms which Dainton commits to. Can all our rapid responses to stimuli plausibly be treated as automatic, as opposed to consciously guided (Dennett 122)? If not, we might seem impelled towards Grush's picture. Partly motivated by this concern, Phillips ('Perception and Iconic Memory' §4.3, 'The Temporal Structure of Experience') argues for a 'third way' approach to postdiction, which avoids both amnesia and delay, and moreover is consistent with inheritance.¹¹ We can approach Phillips' account via Dainton's own 'extensionalist' model of temporal experience. Recall, that according to Dainton's extensionalism, awareness is not 'packaged into momentary acts' (*Stream of Consciousness* 166) but rather essentially 'extends a short distance through ordinary objective time' ('The Experience of Time and Change' 625) – roughly half a second Dainton reckons. Extensionalism is intended to explain how our experience can 'accommodate' motion and change. For it to serve that function, the mere claim that our experience is extended in time is insufficient. Rather, as Dainton ('Temporal Consciousness') recognises, what is crucial is that there obtain 'experiential connections between the neighbouring phases of our streams of consciousness' such that 'adjoining stream-phases [are] not ... logically independent of one another' (§6.1; cf. Phillips 'Perceiving Temporal Properties').

The existence of such connections between nearby phases of experience dramatically affects our analysis of the cutaneous rabbit data. Consider again a subject's experience immediately after delivery of the second pulse. We apparently faced two exhaustive options: more-or-less immediate experience of pulse-at-wrist followed by overwriting, or delayed experience of pulse-further-up-arm. However, if a subject's experience at a time is logically dependent on facts about experience at later times, we cannot say what a subject is experiencing immediately after the second pulse without taking into account facts about her later experience, and in particular whether she goes on to experience a sixth pulse or not. In consequence, a subject may have *different* experiences of the second pulse's location – without need for delay or over-writing – because such experiences constitutively depend on facts about later experience.

3. Silencing and Inheritance

Watzl argues that a quite different set of empirical effects shows, *contra* inheritance, that 'which temporal changes we are experiencing bears no close relation to how our experience itself is changing over time' (1010). These are the striking motion silencing effects reported in Suchow and Alvarez.¹² Consider the following paradigm. Subjects view a ring of one hundred randomly positioned, non-overlapping, multi-coloured dots, centred on a fixation mark (Fig. 2). During each trial, every dot constantly changes colour, cycling fairly rapidly around the colour wheel.

Trials comprise two alternating conditions: an initial *stationary* condition in which the ring is motionless, and subjects see the dots rapidly changing in colour, and a subsequent *rotation* condition, in which the ring rotates as a whole about the fixation point, and during which subjects no longer perceive all the dots as changing colour rapidly.

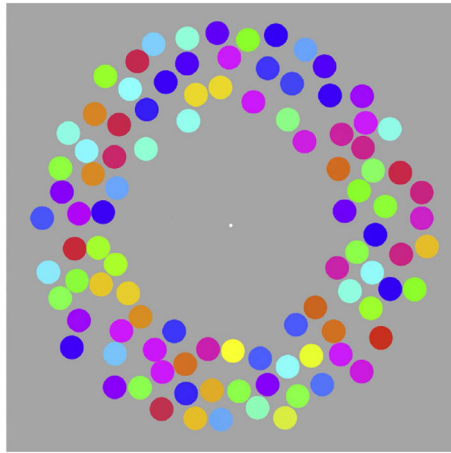


Fig. 2. Example of display used in Suchow and Alvarez (141, Fig. 1). Copyright © 2011, Elsevier. Reprinted with permission.

What subjects do perceive, however, is a matter of significant contention. Unquestionably, silencing effects are graded, in that at increasing rotation speeds, the amount of perceived change decreases. But this notion of ‘amount of perceived change’ is ambiguous. Suchow and Alvarez, and Watzl who follows them, hold that subjects experience increasingly slow colour changes of *all* the dots’ at increasingly high rotation speeds. Phillips (‘Breaking the Silence’) disputes this, proposing instead that subjects experience increasingly *few* of the dots as changing in colour at the speed they in fact do.

This matters because, if Phillips is right, a simple understanding of silencing as a form of change blindness is available. In classic cases of change blindness (see Rensink, and Simons and Rensink for reviews) plainly visible changes go unreported, and arguably unexperienced, due to the capture or task-driven diversion of attention. For instance, the colour of a background may visibly change whilst a viewer is focused on tracking a series of objects moving in front of it. Here, the viewer may fail to report, and arguably experience, the background change as such, even though plausibly at any time during the trial their experience accurately presents the current colour of the background. Similarly, in silencing – conceived of as a form of change blindness – the increasingly rapid global motion of the ring of dots causes subjects to fail to see the local colour changes of increasingly many individual dots. Neither paradigm cases of change blindness, nor silencing so understood, conflict with inheritance. This is because such cases involve *failures* to perceive temporal properties. And if a temporal property is not apparently presented in experience, then no constraint is imposed on the structure of experience whatsoever. As emphasised above, inheritance is the claim that for any temporal property which *is* apparently presented in experience, experience itself has that temporal property. If silencing is a matter of the colour changes of more and more dots being *missed* as the ring rotates increasingly fast, silencing effects provide no threat to inheritance.

Matters are different if Suchow and Alvarez, and Watzl, are right about the way in which silencing is graded. If the dots *all* appear to change colour more slowly than they are in fact changing colour, then silencing involves us consciously misperceiving change. Inheritance then tells us that our experience must be changing at a rate which matches the apparent rate of change perceived. The problem is that there is evidence that experience itself does *not* change at this rate. The evidence comes from a series of change-detection or ‘flipping’ experiments (Suchow and Alvarez, Experiment 3). In these experiments, after a stationary

period, the coloured ring of dots rotates just 180° over 2.4 s. During this half-rotation, the dots all cycle halfway (180°) around the colour wheel (e.g. from yellow to purple). At the end of the half-rotation, all of the dots then ‘flip’ to a hue at a random common distance (e.g. 60°) around the colour wheel from their current colour and then either stop rotating or continue to do so. The crucial finding is that subjects report a colour change (a ‘flip’) when the flip-distance is significantly *different* from zero but fail to report a colour change when the flip-distance is *insignificantly different* from zero (140). Watzl, following Suchow and Alvarez, takes this result to show that subjects veridically experience the actual colours of the dots throughout the rotation condition. That is, in the rotation condition, subjects’ experience is in fact changing just as rapidly as the dots are actually changing colour. If this is right, then, assuming silencing is graded in the way which Watzl supposes, inheritance fails.

Several questions need raising about the interpretation of the flipping data, and in particular what can be inferred from the ability of subjects to detect flips. Waltz’s argument requires that subjects continuously consciously update their representation of the dots’ colours. Against this, Burr argues, ‘The same/different discrimination could be based solely on the transition of the stopped to the flipped image, without subjects having to ‘update’ anything’ (R161). Phillips (‘Breaking the Silence’) also notes that we cannot assume that, just because subjects are consciously aware of a ‘flip’ *at the end* of the rotation condition, subjects were consciously tracking the colours *throughout* the condition. Cases of perceptual re-entry (Mitroff and Scholl ‘Seeing the disappearance of unseen objects’, ‘Forming and updating object representations without awareness’, Wu et al.) suggest otherwise. Both these objections raise a further more general issue, namely, how determinate we should think of subjects’ experiences of the dots as being in both conditions. After all, as Phillips notes, ‘the number of dots in Suchow and Alvarez’s ring is roughly double the number of speckles on Ryle’s notorious speckled-hen (e.g. Ayer, Chisholm), and ... vastly greater than the capacity of working-memory (e.g. Luck and Vogel)’ (‘Breaking the Silence’). Without answers to these many questions, it remains wide-open whether silencing conflicts with inheritance.¹³

4. Duration, Order and Inheritance

Lee (‘Temporal Experience and the Temporal Structure of Experience’ §3.1) points to a number of putative empirical counter-examples to inheritance as part of a broader critique of what he calls ‘mirroring’ views. Considering these are instructive in clarifying the commitments that inheritance incurs.

Lee first proposes several counterexamples to inheritance on the assumption that we perceive *metrical* temporal properties, e.g., that we might hear a sound as apparently lasting *two seconds*, in which case (by inheritance) we would have to enjoy an experience of that sound itself lasting two seconds. As Lee points out (see also Phillips ‘Perceiving the Passing of Time’), the combination of metrical content and inheritance is problematic. Under extreme stress, or due to the action of various pharmacological substances, subjects commonly report that ‘time seemed to slow down’ (for references see Phillips ‘Perceiving the Passing of Time’). On the assumption that we perceive metrical temporal properties, it is natural to think of such cases as duration *illusions* in which events are perceived as lasting a great deal longer than they actually do. Thus, a subject might experience a car crash as lasting twenty seconds, despite it actually being over within just two. The root problem for inheritance is simply the sheer implausibility that our experiences of such traumatic events outlive those events by many seconds.

Phillips ('Perceiving the Passing of Time') reconciles inheritance with such cases by rejecting the assumption that we perceive metrical durations, and more generally the assumption that our experience tracks the *absolute* durations of environmental events. Instead, Phillips suggests that we only ever perceive *relative* durations. This may seem obviously unsatisfactory insofar as cases of time slowing down are *global* distortions. However, this neglects the fact that our waking lives are constantly accompanied by a stream of conscious *non-perceptual* mental activity, a stream of thought in the broadest sense. What is happening when 'time seems to slow down', Phillips hypothesises, is that there is a dramatic increase in the amount of activity in the stream of thought during the crisis events. The crisis events are thus experienced as occurring over a period of time during which a great deal of mental activity occurs – much more than would normally occur during a period of that objective duration. (For supporting evidence, see Noyes and Kletti, and Arstila.) This arguably accounts for the phenomenology without threat to inheritance. There is no threat since the relevant instance of inheritance holds that, if events are presented as apparently unfolding over a period of time during which a great deal of mental activity occurs, then our experience itself must unfold over a period of time during which a great deal of mental activity occurs. And this is precisely what it does do according to the hypothesis at hand.

Lee floats an alternative response to cases of 'time slowing down'. This insists that inheritance applies only to sub-second timing and excludes trauma and drug-induced distortions on the basis that they concern supra-second timing. This is not entirely *ad hoc*. Distinct timing mechanisms at different time scales are a frequent theme in empirical work (Lee cites Rammsayer, though cf. Lewis and Miall). Moreover, it is common in philosophical discussions to privilege a short period of time, often referred to as the specious present, over which we 'directly' experience motion and change. If we embrace this (admittedly vexing) idea, it is natural to think that only durations presented within the specious present are candidates for inheritance to apply to, since at longer timescales memory will inevitably be involved, and inheritance will no longer be guaranteed.

Against this response, Lee points to another putative counter-example, the long-attested fact that 'sounds are judged longer than lights' (Goldstone and Lhamon), or as Lee puts it that 'auditory stimuli are systematically judged to last longer than visual stimuli of the same length'. Lee rightly notes that this effect obtains at sub-second timescales. In fact, it is one of a wealth of cases in which brief stimuli of equal duration but differing in some other feature dimension (e.g. intensity, emotional valence, pitch or speed) have different subjective durations (Wearden et al. 97–8). However, it is less obvious that Lee is right to take the sounds versus lights case to be 'a particularly compelling counterexample to metrical matching [and so inheritance]'.

Inheritance – metrical or otherwise – would be directly threatened by a case in which *simultaneously presented* lights and sounds seemed to have common onset and offset but yet were judged to differ in apparent duration. However, in their studies of simultaneously presented auditory and visual stimuli, Walker and Scott found that when presented together, the auditory stimulus dominates or captures the visual stimulus, such that both are judged longer than a visual stimulus presented *alone* (a finding interpreted by Wearden et al. as supporting a single common pacemaker model). This result is quite consistent with inheritance. On the other hand, the non-simultaneous case only conflicts with metrical inheritance given at least two further assumptions: (a) that the lights and sounds are veridically represented and (b) that the comparative duration judgments directly reflect the presented durations of the lights and sounds. The metrical theorist might question either assumption.

Might there be cases in which two stimuli are perceived to have different durations despite apparently having a common onset and offset? One tentative report of such a case comes in preliminary and unpublished work from Peter Tse's lab (Tse 148). The work concerns the so-called oddball effect in which a briefly presented unique stimulus (e.g. a red disc) embedded in a train of standard stimuli (e.g. black discs) of the same duration seems to last up to 25% longer than the average of the standard stimuli (Tse et al.). Tse's 'baffling' finding is that 'a constant-tone sound standard does *not* seem to last longer ... relative to other sound standards, when a visual [oddball] stimulus with simultaneous onset and offset as the sound standard undergoes temporal expansion' (148). It is hard to evaluate this finding without further experimental details. However, even if it is borne out, this is murky territory; Tse's interpretation of the oddball effect is controversial both empirically (Pariyadath and Eagleman) and philosophically (Phillips 'Perceiving the Passing of Time' §6). Again, the cliché that further research is needed manifestly applies.

Finally, Lee raises a very different case against inheritance irrespective of any commitment to metrical content. This is the well-known finding that at very short-timescales, we can perceive events as non-simultaneous without perceiving their temporal order.¹⁴ Lee writes: 'To literally mirror this content, the experiences would have to be themselves non-simultaneous without having some particular temporal order. Assuming they do have some particular temporal order, is this consistent with [inheritance]? Why don't I experience this temporal order? ... The example at least demands further explanation'.

The simplest response to this objection is to recall that inheritance is a one-way thesis. It holds that all properties which are apparently presented in experience must be inherited by experience itself; it does not hold that all temporal properties of experience are experienced properties. In the present case, the apparently presented temporal property is simply non-simultaneity. Given this, we would have a counter-example to inheritance only if the relevant experiences were simultaneous. And we have no reason to believe they are.

Lee presses that if the temporal experiences really do have an order, then we are owed an explanation of why this is not an experienced order. It is unclear why the inheritance theorist owes any better explanation here than that we have limited powers of perceptual discrimination.¹⁵ However, we might also question whether Lee is right to assume that the experiences themselves have a determinate temporal order. Even if we accept that any set of physical events must have a determinate order, in the absence of a substantive metaphysics of experience, it is not obvious that conscious experiences must, especially when such an order would outstrip our powers of discrimination (Phillips *Experience and Time* 221 f., cf. Dennett 132). Clearly, if our conscious experiences lack a determinate order in these cases, no counter-example to inheritance is forthcoming.

5. Conclusion

I have considered a wide-range of empirical effects alleged to be inconsistent with the inheritance principle that for any temporal property apparently presented in our experience, our experience itself inherits that temporal property. None proved unassailable. Nonetheless, whether or not they are ultimately successful in undermining inheritance, careful consideration of such challenges, and empirical work more generally, undoubtedly has much to teach us about the relationship between our experience of time, and the structure of our experience in time.

Short Biography

Ian Phillips' research is chiefly in philosophy of mind and cognitive science. He has authored papers in these areas for *Mind and Language*, *Philosophy and Phenomenological Research*, *Philosophical Studies*, *Philosophical Perspectives*, *The Philosophical Quarterly* and *The Proceedings of the Aristotelian Society*. In 2011, he was awarded with the William James Prize for Contributions to the Scientific Study of Consciousness by the Association for the Scientific Study of Consciousness. Supported by a Leverhulme Research Fellowship, he is currently working on a book entitled *Our Experience of Time*. This defends and elaborates a 'naïve' conception of temporal experience in connection with a range of philosophical and empirical issues. His academic career to-date has been divided between University College London (UCL) and Oxford University. He studied for his PhD at UCL, won a fellowship by examination at All Souls College, Oxford, then took up a lectureship at UCL, before recently returning to Oxford as a lecturer and Gabriele Taylor Fellow at St Anne's College.

Notes

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¹ See, for example, Broad 286–7, 351; Foster *The Case for Idealism* 255; Dainton *Stream of Consciousness* 115; Hoerl 'Time and Tense in Perceptual Experience' 1; and Phillips 'Perceiving Temporal Properties' 176–77.

² Dainton 'The Experience of Time and Change' offers an excellent brief introduction to these issues. See also Dainton *Stream of Consciousness*, 'Temporal Consciousness'; Phillips 'Perceiving Temporal Properties', 'The Temporal Structure of Experience'; Le Poidevin; and Gallagher.

³ Cf. Plumer: 'We hear sounds *while* they are going on. ... The natural answer to the question of how long one hears a sound or sequence of sounds is the very length of the sound or sequence' (26, his emphasis); also Dainton *Stream of Consciousness* 134.

⁴ See, e.g., Dennett, Shoemaker, Chalmers 194–5, Martin §7, Phillips 'Perceiving Temporal Properties'.

⁵ Foster writes that 'we have to take experience to extend over a period of real time in a way which exactly matches the phenomenal period it presents' (*The Immaterial Self* 249). And Dainton, in the context of endorsing Foster's theory, writes that 'even if we draw an awareness-content distinction [which Dainton ultimately rejects] it makes no sense to suppose that an act of awareness can apprehend a content of a greater temporal duration than itself' (*Stream of Consciousness* 180). One important qualification here is that both Foster and Dainton are sense-datum theorists. Thus, they do not think of experience as directly inheriting the temporal properties of events in the world.

⁶ For extensive discussion of extensionalism and retentionalism, see Dainton 'The Experience of Time and Change', *Stream of Consciousness*, and 'Temporal Consciousness'. For further discussion of what is fundamentally required for experience to accommodate change and persistence, see Phillips 'Perceiving Temporal Properties', Soteriou 'Perceiving Events', and Lee 'Temporal Experience and the Temporal Structure of Experience'.

⁷ For recent discussions, see Dainton *Stream of Consciousness* esp. Ch.4, §2, Tye Ch.1, Bayne Ch.2, §2, and Hoerl "'A Succession of Feelings, in and of Itself, is Not a Feeling of Succession'". In this author's opinion, a promising approach to these issues is to begin with the kind of ontological framework concerning events and processes developed most fully in Crowther's recent work. Applied to experience, such a framework offers the prospect of reconciling apparently conflicting intuitions about the individuation of experiences. For instance, we might think that (*pace* Bayne and Hoerl) Tye's 'one experience' view rightly recognised experiences in what Crowther would call a 'resultant accomplishment' sense but failed to recognise that other principles of organisation (e.g. concerning their objects) might afford us with experiences in what Crowther would call a 'genuine accomplishment' sense.

⁸ For relevant discussion of the temporal fine structure of auditory experience, see Phillips 'Indiscriminability and Experience of Change' §9 and *passim*.

⁹ For discussion of Dennett and Kinsbourne, see Phillips *Experience and Time* Ch.5.

¹⁰ See also Lachter and Durgin. For more detailed discussion, see Phillips 'Perception and Iconic Memory' §4.2.

¹¹ See also Hoerl 'Time and Tense in Perceptual Experience' and, for important background discussion, Soteriou 'Content and the Stream of Consciousness'.

¹² A series of demonstrations can be found here: <http://visionlab.harvard.edu/silencing/>. A demonstration of the colour case which allows adjustment of rotation speed can be found here: http://www.michaelbach.de/ot/mot_silencing/index.html.

- ¹³ Those interested in following up empirical issues about silencing and change detection should see Turi and Burr, Saiki and Holcombe, Goddard and Clifford, and Peirce.
- ¹⁴ This finding has long been known, see James (610). For empirical studies, see Hirsh and Sherrick, and Pöppel, both discussed by Hoerl 'The perception of time and the notion of a point of view'.
- ¹⁵ On the demand for such explanations more generally, see Hoerl 'Time and Tense in Perceptual Experience', and Phillips 'Breaking the Silence' fn.12

Works Cited

- Alpern, Matthew. 'Metacontrast.' *Journal of the Optical Society of America* 43 (1953): 648–57.
- Artala, Valterri. 'Time slows down during accidents.' *Frontiers in Psychology: Theoretical and Philosophical Psychology* 3:196 (2012): 1–10.
- Ayer, Alfred J. *The Foundations of Empirical Knowledge*. London: Macmillan, 1940.
- Bayne, Tim. *The Unity of Consciousness*. Oxford: OUP, 2010.
- Brentano, Franz. *Philosophical Investigations on Space, Time and the Continuum*. Trans. Barry Smith. Beckenham: Croom Helm, 1988.
- Broad, Charlie Dunbar. *Scientific Thought*. London: Routledge & Kegan Paul, 1923.
- Burr, David. 'Visual perception: more than meets the eye.' *Current Biology* 21.4 (2011): R159–61.
- Chalmers, David. *The Conscious Mind*. Oxford: OUP, 1996.
- Chisholm, Roderick. 'The problem of the speckled hen.' *Mind* 51.204 (1942): 368–73.
- Choi, Hoon and Brian J. Scholl. 'Perceiving causality after the fact: postdiction in the temporal dynamics of causal perception.' *Perception* 35 (2006): 385–99.
- Chuard, Philippe. 'Temporal Experiences and Their Parts.' *Philosophers' Imprint* 11.11 (2011): 1–28.
- Crowther, Thomas. 'The matter of events.' *The Review of Metaphysics* 65 (2011): 3–39.
- Dainton, Barry. 'Sensing change.' *Philosophical Issues* 18.1 (2008): 362–84.
- . *Stream of Consciousness: Unity and Continuity in Conscious Experience*. London: Routledge, 2000, revised edition, 2006.
- . 'Temporal consciousness.' *The Stanford Encyclopedia of Philosophy*. Fall 2010 ed. Ed. Edward N. Zalta. <<http://plato.stanford.edu/archives/fall2010/entries/consciousness-temporal/>>. Last accessed 16 November 2013.
- . 'The Experience of Time and Change.' *Philosophy Compass* 3/4 (2008): 619–38.
- Dennett, Daniel C. *Consciousness Explained*. Boston MA: Little Brown & Co, 1991.
- Dennett, Daniel C. and Marcel Kinsbourne. 'Time and the observer: the where and when of consciousness in the brain.' *Behavioral and Brain Sciences* 15 (1992): 183–200.
- Eagleman, David M. and Terrence J. Sejnowski. 'Motion Integration and Postdiction in Visual Awareness.' *Science* 287 (2000): 2036–8.
- . 'The line-motion illusion can be reversed by motion signals after the line disappears.' *Perception* 32 (2003): 963–8.
- Enns, James T. and Vincent Di Lollo. 'What's new in visual masking?' *Trends in Cognitive Sciences* 4 (2000): 345–52.
- Foster, John. *The Case for Idealism*. London: Routledge & Kegan Paul, 1982.
- . *The Immaterial Self*. London: Routledge & Kegan Paul, 1991.
- Gallagher, Shaun. *The Inordinance of Time*. Evanston: Northwestern University Press, 1988.
- Geldard, Frank and Carl E. Sherrick Jr. 'The cutaneous "rabbit": a perceptual illusion.' *Science* 178.57 (1972): 178–9.
- Goddard, Erin and Colin W. G. Clifford. 'A new type of change blindness: smooth, isoluminant color changes are monitored on a coarse spatial scale.' *Journal of Vision* 13.5 (2013): 1–8.
- Goldstone, Sanford and William T. Lhamon. 'Studies of auditory-visual differences in human time judgment: 1. Sounds are judged longer than lights.' *Perceptual and Motor Skills* 39 (1974): 63–82.
- Grush, Rick. 'Time and experience.' *Philosophie der Zeit*. Ed. Thomas Müller. Frankfurt: Klosterman, 2007. 27–44.
- Hirsh, Ira J. and Carl E. Sherrick Jr. 'Perceived order in different sense modalities.' *Journal of Experimental Psychology* 62 (1961): 423–32.
- Hoerl, Christoph. "'A succession of feelings, in and of itself, is not a feeling of succession'." *Mind* 122.486 (2013): 373–417.
- . 'The perception of time and the notion of a point of view.' *European Journal of Philosophy* 6.2 (1998): 156–71.
- . 'Time and tense in perceptual experience.' *Philosophers' Imprint* 9.12 (2009): 1–18.
- Husserl, Edmund. *On the Phenomenology of Consciousness of Internal Time (1893–1917)*. Trans. John B. Brough. Dordrecht: Kluwer Academic, 1991. Publishers, 1991.
- James, William. *The Principles of Psychology*. New York: Henry Holt, 1890.
- Kolers, Paul A. and Michael von Grünau. 'Shape and Color in Apparent Motion.' *Vision Research* 16 (1976): 329–35.

- Lachter, Joel and Frank Durgin. 'Metacontrast masking functions: a question of speed?' *Journal of Experimental Psychology* 25 (1999): 936–47.
- Lachter, Joel, Frank Durgin, and Tori Washington. 'Disappearing percepts: evidence for retention failure in metacontrast masking.' *Visual Cognition* 7 (2000): 269–79.
- Le Poidevin, Robin. *The Images of Time: An essay on Temporal Representation*. Oxford: Oxford University Press, 2007.
- Lee, Geoffrey. 'Consciousness in a Space-Time World.' *Philosophical Perspectives* 21.1 (2007): 341–74.
- . 'Temporal Experience and the Temporal Structure of Experience.' *Philosophers' Imprint* forthcoming.
- Lewis, Penelope A. and R. Chris Miall. 'The precision of temporal judgement: milliseconds, many minutes, and beyond.' *Philosophical Transactions of the Royal Society of London, Series B* 364 (2009): 1897–905.
- Luck, Steven J. and Edward K. Vogel. 'The capacity of visual working memory for features and conjunctions.' *Nature* 390 (1997): 279–81.
- Mackay, Donald M. 'Perceptual stability of a stroboscopically lit visual field containing self-luminous objects.' *Nature* 181 (1958): 507–8.
- Martin, Michael G. F. 'On being alienated.' *Perceptual Experience*. Eds. Tamar S. Gendler and John Hawthorne. Oxford: Oxford University Press, 2006: 354–410.
- Miller, Izchak. *Husserl, Perception and Temporal Awareness*. Cambridge, MA.: MIT Press, 1985.
- Mitroff, Stephen R. and Brian J. Scholl. 'Forming and updating object representations without awareness: evidence from motion-induced blindness.' *Vision Research* 45 (2005): 961–7.
- . 'Seeing the disappearance of unseen objects.' *Perception* 33 (2004): 1267–73.
- Nijhawan, Romi. 'Motion extrapolation in catching.' *Nature* 370 (1994): 256–7.
- Noyes, Russell Jr. and Roy Kletti. 'Depersonalization in response to life-threatening danger.' *Comprehensive Psychiatry* 18.4 (1977): 375–84.
- Pariyadath, Vani and David Eagleman. 'The Effect of Predictability on Subjective Duration.' *PLoS ONE* 2.11 (2007): 1–6.
- Phillips, Ian B. 'Breaking the silence: motion silencing and experience of change.' *Philosophical Studies* forthcoming.
- . 'Experience and time.' Diss. University College London, 2009.
- . *Our Experience of Time*. forthcoming.
- . 'Perceiving temporal properties.' *European Journal of Philosophy* 18.2 (2010): 176–202.
- . 'Perceiving the passing of time.' *Proceedings of the Aristotelian Society* 113.3 (2013): 225–252.
- . 'Perception and iconic memory.' *Mind & Language* 26 (2011): 381–411.
- . 'The temporal structure of experience.' *Subjective Time: the Philosophy, Psychology, and Neuroscience of Temporality*. Eds. Dan Lloyd and Valtteri Arstila. Cambridge, MA: MIT Press, forthcoming.
- Peirce, Jon W. 'Is it just motion that silences awareness of other visual changes?' *Journal of Vision* 13.7 (2013): 1–10.
- Plumer, Gilbert. 'The myth of the specious present.' *Mind* 94.373 (1985): 19–35.
- Pöppel, Ernst. 'Time perception.' *Perception*. Eds. Richard Held, Herschel Leibowitz, and Hans-Lukas Teuber. Berlin: Springer-Verlag, 1978. 713–29.
- Prichard, Harold A. 'The apprehension of time.' *Knowledge and Perception*. Oxford: Clarendon Press, 1950: 47–51.
- Rammsayer, Thomas H. 'Neuropharmacological evidence for different timing mechanisms in humans.' *The Quarterly Journal of Experimental Psychology: Section B* 52.3 (1999): 273–86.
- Rashbrook, Oliver. 'An appearance of succession requires a succession of appearances.' *Philosophy and Phenomenological Research* 87.3 (2013): 584–610.
- Reid, Thomas. *Essays on the Intellectual Powers of Man*. Ed. Derek R. Brookes, with annotations by Derek R. Brookes and Knud Haakonssen. Edinburgh: Edinburgh University Press, 2002.
- Rensink, Ronald A. 'Change detection.' *Annual Review of Psychology* 53 (2002): 245–77.
- Robinson, Howard. *Perception*. New York: Routledge, 1994.
- Saiki, Jun and Alex O. Holcombe. 'Blindness to a simultaneous change of all elements in a scene, unless there is a change in summary statistics.' *Journal of Vision* 12.3 (2012): 1–11.
- Sekuler, Robert, Allison B. Sekuler, and Renee Lau. 'Sound alters visual motion perception.' *Nature* 385 (1997): 308.
- Shoemaker, Sydney. 'Self-knowledge and "inner-sense".' *Philosophy and Phenomenological Research* 54 (1994): 249–314.
- Simons, Daniel J. and Ronald A. Rensink. 'Change blindness: past, present, and future.' *Trends in Cognitive Sciences* 9 (2005): 16–20.
- Soteriou, Matthew J. 'Content and the stream of consciousness.' *Philosophical Perspectives* 21.1 (2007): 543–68.
- . 'Perceiving events.' *Philosophical Explorations* 13.3 (2010): 223–41.
- . 'The perception of absence, space, and time.' *Perception, Causation, and Objectivity*. Eds. Johannes Roessler, Hemdat Lerman, and Naomi Eilan. Oxford: Oxford University Press, 2011: 181–206.
- Suchow, Jordan W. and George A. Alvarez. 'Motion silences awareness of visual change.' *Current Biology* 21.2 (2011): 140–3.
- Tse, Peter Ulric. 'Attention underlies subjective temporal expansion.' *Attention and Time*. Eds. Anna C. Nobre and Jennifer T. Coull. Oxford: Oxford University Press, 2010: 137–50.
- Tse, Peter Ulric, Josée Rivest, James Intriligator, and Patrick Cavanagh. 'Attention and the subjective expansion of time.' *Perception & Psychophysics* 66.7 (2004): 1171–89.

- Turi, Marco and David Burr. 'The "motion silencing" illusion results from global motion and crowding.' *Journal of Vision* 13.5 (2013): 1–7.
- Tye, Michael. *Consciousness and Persons: Unity and Identity*. Cambridge, MA: MIT Press, 2003.
- Walker, James T. and Karen J. Scott. 'Auditory-visual conflicts in the perceived duration of lights, tones, and gaps.' *Journal of Experimental Psychology: Human Perception and Performance* 7 (1981): 1327–39.
- Watzl, Sebastian. 'Silencing the experience of change.' *Philosophical Studies* 165 (2013): 1009–32.
- Wearden, John H., H. Edwards, M. Fakhri, and A. Percival. 'Why "Sounds Are Judged Longer Than Lights": Application of a Model of the Internal Clock in Humans.' *The Quarterly Journal of Experimental Psychology* 51B.2 (1998): 97–120.
- Wertheimer, Max. 'Experimentelle Studien über das Sehen von Bewegung.' *Zeitschrift für Psychologie* 61 (1912): 161–265.
- Wu, Chien-Te, Niko A. Busch, Michèle Fabre-Thorpe, and Rufin VanRullen. 'The temporal interplay between conscious and unconscious perceptual streams.' *Current Biology* 19 (2009): 2003–7.