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Breaking the silence: motion silencing and experience of change

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Abstract The *naïve view of temporal experience* (Phillips, in: Lloyd D, Arstila V (eds) Subjective time: the philosophy, psychology, and neuroscience of temporality, forthcoming-a) comprises two claims. First, that we are perceptually aware of temporal properties, such as succession and change. Second, that for any temporal property apparently presented in experience, our experience itself possesses that temporal property. In his paper 'Silencing the experience of change' (forthcoming), Watzl argues that this second *naïve inheritance* thesis faces a novel counter-example in the form of the striking motion silencing effects recently demonstrated by Suchow and Alvarez (Curr Biol 21(2):140–143, 2011). Here I clarify the form which any counter-example to naïve inheritance must take. I then explain how, on a plausible, rival 'crowding' interpretation of Suchow and Alvarez's data, motion silencing poses no more of a threat to naïve inheritance than standard cases of change blindness.

Keywords Temporal consciousness · Experience of change · Motion silencing · Change blindness · Crowding

1 Introduction

The *naïve view of temporal experience* (Phillips forthcoming-a) comprises two claims. First, that we are perceptually aware of temporal properties, such as succession and change. Second, that for any temporal property apparently presented in experience, our experience itself possesses that temporal property. In his paper 'Silencing the experience of change' (forthcoming), Watzl argues that this second *naïve inheritance* thesis faces a novel counter-example in the form of the striking

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motion silencing effects recently demonstrated by Suchow and Alvarez (2011).[1] More generally, Watzl claims that silencing effects show that 'which temporal changes we are experiencing bears no close relation to how our experience itself is changing over time' (Watzl forthcoming, §1).[2]

I begin by describing and motivating the naïve view in more detail, dwelling on the form which any successful counter-example to naïve inheritance must take. In particular, I explain why cases of change blindness do not constitute counter-examples (Sect. 2). I then turn to motion silencing. After surveying the basic data concerning such effects presented by Suchow and Alvarez, I explain precisely why Watzl takes them to exhibit the form of a counter-example to naïve inheritance. In particular, I highlight a crucial assumption (one shared by Suchow and Alvarez) concerning the way in which silencing is graded (Sect. 3). I then explain why this assumption is not mandatory and offer a plausible, rival 'crowding' interpretation of Suchow and Alvarez's silencing data, which suggests a very different account of the way in which silencing is graded. On this interpretation motion silencing poses no more of a threat to naïve inheritance than familiar cases of change blindness (Sect. 4). I end by responding to a natural, though ultimately unfounded, objection to my account (Sect. 5).

2 The naïve view and the form any counter-example must take

The naïve view of temporal experience comprises two claims. First, that we are perceptually aware of temporal properties, such as succession and change. Second, that for any temporal property apparently presented in experience, our experience itself possesses that temporal property.[3] The first of these claims, which we might call *realism*, needs little defence. As Foster puts it: 'duration and change through time seem to be presented to us with the same phenomenal immediacy as homogeneity and variation of colour' (1982, p. 255).[4] The second *naïve inheritance* claim may seem less obvious than *realism*, not least if we consider the perception of temporal properties alongside the perception of other features such as colour and shape. For, whilst we experience colour and shape, experience itself, at least in its subjective aspect, is neither coloured nor shaped. Thus, the view that experience

[1] The suggestion that the naïve view is inconsistent with certain perceptual effects and illusions is long-standing. It is made, for example, in Dennett and Kinsbourne (1992) and Grush (2007) by appeal to so-called postdictive effects (see Dainton 2008; Hoerl 2009; Phillips forthcoming-a for responses). Watzl also mentions Lee (2009) where a distinct range of effects—most saliently the so-called 'oddball' effect (Tse et al. 2004; Eagleman 2008)—are presented as counter-examples. In my view, these cases raise rather different concerns from those raised by motion silencing (see Phillips 2013 for a response).

[2] As Watzl notes (§2, fn. 3) silencing effects would thus provide a counter-example to the views of, amongst others, Mellor (1985), Foster (1991), Dainton (2000), and Hoerl (2009).

[3] For a defence of the naïve view see Phillips (forthcoming-a, 2009, 2010, 2013).

[4] Cf. Dainton (2000, p. 115) who takes realism to be a 'phenomenological constraint' on theorizing in this area, 'an obvious truth', the 'most basic of facts'. Likewise see the openings of Hoerl (2009) and Phillips (2010). Despite realism's seeming obviousness, certain theorists have felt compelled to deny it. For discussion and references see Phillips (2010) and Dainton (2000, esp. §5.6).

inherits these aspects of its objects is at best subjectively unmotivated, and at worst incoherent. However, in contrast, experience does manifestly have a temporal profile: our experience is constituted of events and/or processes which persist through time and occur in temporal relation to one another. Here therefore a question about the relation between the temporal properties encountered in experience, and the temporal properties of experience itself, does plainly arise.

The reason for thinking that this relation is that of naïve inheritance stems from simple reflection on how our experience seems to us. For instance, if you hear a car skid and then crash, and then reflect introspectively on whether your auditory experience of the skid came before or after your experience of the crash, it will seem obvious that the order of experiences mirrors the apparent order of their perceived objects. More generally, whilst in the abstract the idea of a divergence between the temporal structure of our experience and the temporal structure of its apparent objects is coherent, such a divergence clashes with the deliverances of introspective reflection. If this is right, then those (like Watzl) who reject naïve inheritance incur an uncomfortable commitment to our experience seeming other than it really is.[5]

Before considering Watzl's charge that motion silencing provides a counter-example to naïve inheritance, we need to clarify exactly what form a successful counter-example must take. First, it is important to appreciate that the naïve view is quite consistent with the existence of temporal illusions. Undeniably, we sometimes misperceive events as occurring in an order different to their actual order. However, since the naïve claim is that the temporal structure of experience inherits the *apparent* (not the actual) temporal structure of the world presented, such cases pose no immediate difficulty for naïveté.[6] For an illusion to constitute a counter-example it would have to be that we were apparently presented with a temporal property whilst our experience itself lacked that property.

Second, although Watzl offers a deliberately vague formulation of his target 'structural matching thesis' in terms of 'a close correspondence' between content and layout of experience, it is crucial to note that *naïve inheritance* only demands a one-way match between experience and its objects. The claim is not that the temporal properties of experience are all and only those presented in experience. Such two-way matching is not plausible since it is clear that our experience may change without us experiencing a change in the world as such. In this minimal sense, the traditional slogan that 'a succession of feelings, in and of itself, is not a feeling of succession' (James 1890/1981, p. 629) is correct.[7]

[5] A full defence of the naïve view is beyond the scope of the present paper. That defence must convince the sceptic that we are indeed introspectively aware of temporal aspects of our experience itself, and render this consistent with the transparency of experience (such as it is). For a much fuller presentation of these ideas see Phillips (2010, forthcoming).

[6] Hoerl (2009, p. 5, fn. 10) concurs. As he also points out, since Dainton and Foster are focused on our (supposed) awareness of purely phenomenal objects, they do not require this qualification.

[7] For further discussion of this slogan see Hoerl (2009), Phillips (2010), Rashbrook (forthcoming). All these discussions explicitly endorse James' slogan to the limited extent that they agree that not every succession of experiences constitutes an experience of succession. Compare Dretske: 'There is more to seeing change than seeing a succession of visibly different states' (2004, p. 2).

The most obvious case in point is that of slow change. Here we can think of perception as having a 'temporal window', and of an object needing to change a sufficient amount within that window in order for change to be perceived. Thus, if the temporal window for vision is n seconds long, and an object must change position by φ degrees of visual angle for it to be in a noticeably different position, then we can think of change as being perceptible only if the object is changing position at a rate greater than or equal to ϕ/n degrees per second (Phillips 2011; cf. Hoerl 2009, §4). In cases where an object moves at a slower rate than this, we may remain in experiential contact with the object and its features throughout an interval in such a way that our experience changes as the object changes position and yet fail to perceive change as such. In such cases, we do not see change, despite experience putting us in a position to know both that there has been a change in the world, and in our experience.

Cases of change blindness (for reviews see Rensink 2002; Simons and Rensink 2005) constitute a more controversial case in which our experience might be thought to track the changes of an object without our perceiving change as such. In cases of change blindness, the relevant changes are fast enough to be perceived. However, perhaps because our attention is elsewhere due to a demanding task or capture by a transient, such changes may nonetheless be missed. For example, in a re-working of his famous gorilla experiment called 'The Monkey Business Illusion', Dan Simons asks subjects to count the sixteen basketball passes of a white-shirted team, intermingled with a black-shirted team.[8] Whilst focused on this task, a gorilla walks into the middle of the court, does a little dance, and exits. Half of naïve subjects miss the gorilla; those expecting the gorilla usually do not. However, even those expecting a gorilla *do* typically miss the fact that the background changes from red to orange during the experiment, an event which is plainly visible (as a change) when one is paying attention. Assuming that our experience itself must be changing on the ground that we see the background as orange at the end and red at the beginning, does such a case threaten naïve inheritance?[9] To see why not, we need to consider two possible accounts of our experience in such cases.

On one interpretation the background colour change *is* consciously perceived as such, but, since the background is unattended, the change is not conceptualized or

[8] See 'The Monkey Business Illusion' at URL = http://www.dansimons.com/videos.html. Last accessed 27 March 2013. For the original work see Simons and Chabris (1999).

[9] Notoriously some theorists take change blindness to evidence the sparseness of visual representation. Those who endorse such a view will likely deny the assumption that our experience genuinely tracks the changing colours (thereby explaining our failure to report the change). However, whilst I do not wish here to commit either way, it is important to note that change blindness is quite consistent with rich representations, and so with the assumption in the main text. Just because our perceptual system continually updates our representation of the changing colour of an object does not logically entail the existence of any representation of the object as changing. That requires some successful cross-temporal comparison, a comparison which may fail for various reasons. On this point see the helpful section entitled 'Limits to what can be inferred from change blindness' in Simons and Rensink (2005). Cf. Dretske (2004, p. 9ff).

encoded in explicit memory, and so available for subsequent verbal report. On this interpretation there is manifestly no problem for naïve inheritance. The change experienced is mirrored by change in our experience. An alternative (and more natural) interpretation of the case is that we do not consciously perceive the background colour change as such, even though our experience does keep track of the background's changing colour. There remains no threat to naïve inheritance on this interpretation, however, since we need not hold that subjects misperceive the background as *unchanging* in colour throughout the trial. Rather they simply fail to perceive the change.[10] As a result, there is simply no relevant *temporal* property apparently presented in experience for experience to inherit. In other words, the temporal content of experience here imposes no constraint on the structure of experience itself whatsoever. To repeat: the naïve claim is that for any temporal property which *is* apparently presented in experience, experience itself has that temporal property. In paradigm cases of change blindness, no relevant temporal property is apparently presented. Thus, such cases pose no threat to the naïve view.

The general moral here is that the naïve inheritance claim only insists on a necessary condition on experiencing a temporal property, viz. that experience itself possess the experienced property. The naïve theorist does not claim that change in experience is, in general, sufficient for experience of change.[11] In Jamesian terms, an experience of succession requires successive experience, but successive experience is not always experience of succession.[12] In consequence, showing that experience has a temporal structure which is not a structure that is experienced will not contradict naïve inheritance. Rather, any putative counter-example to naïve inheritance must (a) point to a temporal property which *is* apparently presented in experience, and (b) demonstrate that this property is not inherited by experience itself.

In the next section, I introduce the basic data concerning motion silencing, and explain why Watzl believes that such effects do genuinely exhibit the form of a counter-example to naïve inheritance. In particular, I make explicit a crucial assumption which Watzl (following Suchow and Alvarez) relies on concerning the way in which silencing is graded. Having done this, I go on (in Sect. 4) to develop a plausible, rival 'crowding' interpretation of Suchow and Alvarez's silencing data, which rejects the assumption and offers an alternative account of the way in which silencing is graded. On this rival interpretation, motion silencing poses no more of a threat to naïve inheritance than standard cases of change blindness. I end by responding to a natural objection to my account (Sect. 5).

[10] For more on the distinction between failing to perceive change and perceiving the absence of change see Sect. 5.

[11] More generally, it is unclear that any of Watzl's targets endorse both a necessary and sufficient condition. Cf. Lee (2009, Chap. 1) who is explicit that the wide range of views which he classifies as 'cinematic' only commit to a necessary condition on experiencing a temporal property.

[12] Precisely when successive experience constitutes experience of succession is arguably an empirical matter which the naïve theorist need take no stand on (cf. Hoerl 2009).

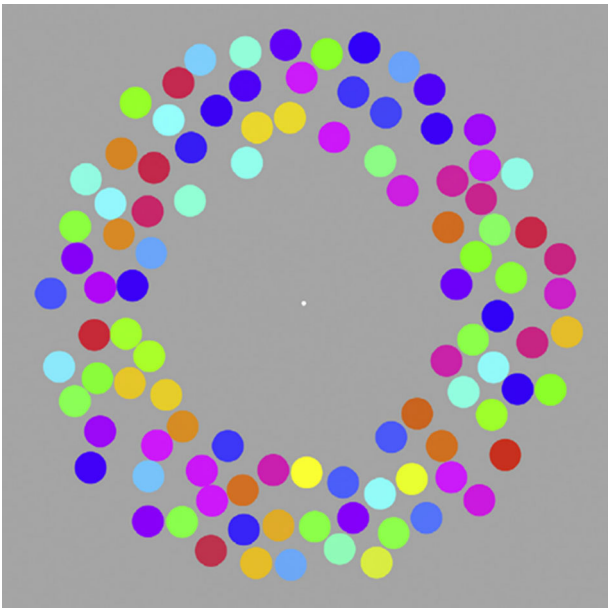

Fig. 1 Example of display used in Suchow and Alvarez (2011, p. 141, Fig. 1). Copyright © 2011, Elsevier. Reprinted with permission

3 Motion silencing

The basic silencing effect works as follows.[13] Subjects are shown a ring of one hundred randomly positioned, non-overlapping dots, centred on a fixation mark (Fig. 1). The dots are multi-coloured, and throughout each trial they constantly change hue, cycling fairly rapidly through the colour wheel.[14]

During a trial there are two alternating conditions: in the initial *stationary* condition the ring is motionless, and subjects see the dots rapidly changing in colour. In the subsequent *rotation* condition, the ring rotates as a whole about the fixation point. In this condition, the dots no longer all appear to be changing colour rapidly, and indeed at certain rotation speeds it is hard to perceive the dots' colour changes at all.

In an idealized fast rotation condition, silencing is naturally thought of as a form of change blindness. The global motion transient due to the rotation of the ring distracts subjects' attention away from the local colour changes of individual dots which are consequently missed. If this is how we should construe silencing, then

[13] For the original work see Suchow and Alvarez (2011). Readers unfamiliar with motion silencing are strongly recommended to see the effect for themselves. A series of demonstrations can be found here: http://visionlab.harvard.edu/silencing/. A demonstration of the colour case by Michael Bach allowing adjustment of rotation speed can be found here: http://www.michaelbach.de/ot/mot_silencing/index.html.

[14] The same effect is found with changes in luminance, size, and shape. Following Watzl, I focus on hue. The points made below apply *mutatis mutandis*.

(though striking) it is neither novel, nor a counter-example to naïveté. It can be handled just as traditional cases of change blindness were handled in the previous section, i.e. on analogy with the discussion of Simons' 'Monkey Business Illusion'.

However, motion silencing is not quite so easily dismissed. It poses a more substantial threat to naïveté because silencing is a *graded* phenomenon in that the effect is smaller at slower rotation speeds.[15] This poses a threat to naïve inheritance insofar as the gradability of silencing is correctly interpreted by Watzl, following Suchow and Alvarez, in terms of subjects experiencing increasingly slow changes of all the dots' colours at increasingly high rotation speeds.[16] That silencing is graded in this specific way is a crucial though unquestioned assumption of Watzl's discussion. It is crucial because, if it is correct to think of subjects as experiencing a certain slow rate of change of all the dots' colours at intermediate rotation speeds, then a certain temporal property (which, as we will see, experience arguably lacks) *is* being apparently presented to subjects. It is not just that certain changes are being missed, rather we are consciously misperceiving change.[17] Given this assumption, then, the first requirement on a counter-example to naïve inheritance is fulfilled, namely that the environment is apparently perceived as having a certain temporal property.

The second requirement on a counter-example is to demonstrate that experience itself lacks the matching temporal property. In order to establish this, Watzl (§4) appeals to a set of change-detection or 'flipping' experiments conducted by Suchow and Alvarez (2011, 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. What Suchow and Alvarez find 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

[15] Because of this Watzl suggests that the phenomenon is more aptly described as 'dampening' (§4).

[16] This formulation and much of Watzl's discussion presupposes that we enjoy a highly determinate experience of the dots in silencing displays. Such a presumption is very controversial (compare, e.g., Tye 2010; Nanay 2010; Stazicker 2011). After all, we only need to reflect that 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 1940; Chisholm 1942), and of course vastly greater than the capacity of working-memory (e.g., Luck and Vogel 1997). Watzl acknowledges that someone might attempt to resist his argument by appealing to indeterminacy in the rotation condition but argues that such appeals are ultimately ineffective (see his §5.3). For present purposes I do not propose to challenge Watzl here and proceed as if our experience of the display is highly determinate. However, I do not myself commit to such a picture. Note that, as Burr (2011) makes clear, we do not need determinate representations of each of the dots to account for the change-detection or 'flipping' data presented by Suchow and Alvarez (2011, Experiment 3) and discussed in the following paragraph: summary statistics of the display colours will serve.

[17] Cf. Watzl's Different Temporal Content (DTC) thesis: 'You experience fast changes of colour in the stationary condition, while you experience much slower changes of colour in the rotation condition, i.e. *you experience a very different rate of change of colour in the two conditions*' (§4). DTC implicitly builds in the relevant assumption about gradability.

insignificantly different from zero (2011, p. 140). Watzl follows Suchow and Alvarez in interpreting the results of the flipping experiment as showing that subjects veridically experience the present colours of the dots throughout the rotation condition, despite failing to notice the *changes* of colour. In other words, he takes such findings to show that, in the rotation condition, subjects' experience is in fact changing just as rapidly as the dots are actually changing colour.[18] If both these requirements are fulfilled, we have a counter-example to naïve inheritance since experience itself changes at a very different rate to the change apparently presented.

The interpretation of the flipping experiments is in fact significantly more delicate than either Watzl, or Suchow and Alvarez, allows. One fundamental issue is whether we should presume that, just because subjects are consciously aware of a 'flip' at the end of the rotation condition, this means that they were *consciously* tracking the colours throughout the condition. Cases of perceptual re-entry (Mitroff and Scholl 2004, 2005; Wu et al. 2009) suggest otherwise. Nonetheless, since in my view the fundamental difficulty with the claim that silencing provides a counter-example to naïve inheritance lies rather with the assumption made about gradability previously identified, I bracket this concern and grant for the sake of the argument that the relevant experiments do establish that our experience of colour in fact changes at the same rate as the dots actually change colour. The naïve theorist who is dissatisfied with my treatment below will naturally wish to revisit this issue and the concerns just noted.[19]

4 Understanding the graded nature of silencing

As Watzl emphasises, whereas at high rotation speeds one almost completely lacks awareness of the dots' colour changes, at slower rotation speeds, one remains aware of the dots' colour changes, though in a way which is somehow 'dampened' (§4, fn. 17).[20] Watzl, following Suchow and Alvarez, assumes that we should understand the effect of slower rotation speeds in terms of the dots all appearing to change increasingly slowly as the global rotation gets faster. This is an assumption built into Suchow and Alvarez's first experiment where subjects are 'asked to adjust the rate of change during the stationary phase to match the apparent rate of change in the moving phase by moving a mouse forward (faster) or backward (slower)' (2011, p. 142). Based on this data different rotation speeds are given a 'silencing factor', said to be 'the ratio of the actual to perceived rate of change'.

If we think of the graded nature of silencing in this way, then we will treat intermediate rotation speeds as cases in which the dots are misperceived as changing

[18] Cf. Watzl's Same Temporal Layout (STL) thesis: 'At each time *t* during the rotation condition just like during the stationary condition, you experience the dots as roughly having the colours they have at *t*, i.e. *your colour experience of colour is changing at roughly the same rate in the two conditions*' (§4).

[19] For dissatisfaction with Suchow and Alvarez's interpretation of the flipping experiments see also Burr (2011) who points out that '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).

[20] Here Bach's demonstration is essential since it allows one to vary the rotation speed.

colour more slowly than they are in fact changing colour. As emphasised above, we will thus have a case of an apparently perceived temporal property for naïve inheritance to apply to. If we further accept that experience itself changes at the same rate that the dots actually change at, we will thereby have a counter-example to naïve inheritance. However, the understanding of dampening that Suchow and Alvarez, and Watzl take for granted is neither mandatory nor established by the relevant data. That is, it is not obvious that we should describe the effect of a slower rotation speed as leading to a percept of the dots all changing colour more slowly than usual. An alternative description is that at slower rotation speeds, greater numbers of dots *escape silencing*. Dots which escape silencing are experienced as changing at the speed at which they are in fact changing: their colour changes are detected. In contrast, silenced dots—those which fail to escape silencing—are simply not perceived as changing at all: their changes go undetected. Silencing is thus graded because, as the rotation gets faster, fewer and fewer dots escape silencing over a given period.

This alternative understanding of the graded nature of silencing is in line with the crowding hypothesis proposed by Burr (2011).[21] Crowding is, roughly, the impairment of object recognition due to the presence of nearby objects.[22] Crowding principally occurs in peripheral as opposed to foveal vision, and in situations where the relevant objects are similar to one another. Both are features of silencing displays. The coloured dots are obviously very similar objects. Moreover, in Suchow and Alvarez's set-up, subjects are instructed to fixate a central mark with the ring of dots being located between 5–8° of visual angle from fixation, i.e. in the (near) periphery.[23] Crowded objects can still be detected (in that subjects are able to discriminate between scenes in which they are present and absent) but they are much harder to identify or recognize than their isolated siblings. Thus, consider a coloured dot which is subject to crowding because tightly surrounded by similar coloured dots and viewed peripherally. It remains open whether, strictly speaking, we can be said to see the dot (as opposed to simply a group of dots collectively, as proposed in Tye (2009). However, even assuming that we do see the individual dot, in such a situation we will be unable reliably to discriminate which colour *d* has, and so, if *d* is changing colour, to perceptually track *d's* colour changes over time.

How does crowding apply to silencing? The basic idea is that the dots in the silencing display are so closely packed together that they are prone to crowding when attending to the central fixation cross (or the dots 'as a whole'). However, in the stationary condition, 'the dynamic change-signals of each element breaks through crowding' (Burr 2011, p. R161)—in other words, the colour changes of individual dots are sufficient for the dots to escape crowding. In contrast, when 'the change-signals are subsumed by global motion mechanisms, we are left with a field

[21] For evidence in favour of this view see Turi and Burr (2011).

[22] For a reviews of crowding in general see Pelli and Tillman (2008), Levi (2008), and Whitney and Levi (2011). For a recent philosophical discussion of issues raised by crowding see Block (2012) and, though not explicitly couched in terms of crowding, Tye (2009).

[23] Foveal vision extends roughly 2° from fixation, parafoveal vision roughly 2–5°; beyond 5° is peripheral vision.

of crowded objects of different … colour, without precise knowledge of which individual dot has which colour' (ibid.)—in other words, the dots fail to escape crowding when the global motion of the ring swamps the local change signals of the individual dots. Burr's crowding hypothesis suggests a very different way of thinking of silencing as graded. The natural way of thinking about gradability from a crowding perspective is in terms of the average number of dots that escape crowding (and so silencing) in a given period. In stationary and slow conditions, most if not all the dots escape crowding. As the ring rotation speed increases, increasingly few dots escape, until, in the idealised, *fast* rotation condition, none do. In this final idealised case, no colour changes at all are perceived. At slower speeds some changes are missed, others perceived.

Watzl will no doubt object that Suchow and Alvarez provide data to support their interpretation of the perception of colour changes in intermediate rotation conditions. In the matching task of Experiment 1 (2011, p. 142; illustrated in their Fig. 1B), Suchow and Alvarez presented subjects with the ring of dots alternating between stationary and rotating conditions every three seconds. Initially, the rate of local colour changes in both conditions was the same. However, observers were instructed to 'adjust the rate of [local colour] change during the stationary phase to match the apparent rate of [local colour] change in the moving phase by moving a mouse forward (faster) or backward (slower)'. Observers slowed the rate of local colour changes in the stationary condition to match the apparent rate of change in the rotation condition. Suchow and Alvarez report this data in terms of silencing factors, a number indicating how much faster the actual rate of change of the rotating display was compared to the slowed rate of change of the matched stationary display. Such factors ranged from roughly 1–10.

It is natural to take these silencing factors to show that in the rotation condition the dots do in fact all appear slowed down. After all, they are judged to match a rate of change in a stationary condition which is significantly slower than their actual rate of change. The difficulty here is that Suchow and Alvarez's matching data do not decisively favour their understanding of gradability. To see this we need to consider whether it would be surprising for Suchow and Alvarez to obtain the relevant data if the crowding hypothesis just sketched were correct. According to the crowding hypothesis, there is no *single* rate of dot change in intermediate rotation conditions. Rather some dots escape crowding and can be perceived as changing rapidly, whilst others fail to escape and are not perceived as changing. Subjects, however, are set a task which presumes that there is an *overall* rate of change to be matched across conditions. As a result, the natural approach for a compliant subject is to match the 'overall amount of change' in the two conditions. Quite how we should think of subjects as making the relevant comparison is a delicate question. One simple proposal would be that they implicitly quantify the overall rate of change in terms of the number of *apparent* cycles though the colour wheel achieved by the dots as a collection. Thus a stationary condition in which all 100 dots are seen to cycle through the colour wheel at 35°/s will match a rotation condition in which the dots are all cycling at 70°/s but only half the dots escape crowding and so are perceived as changing. The crucial point, which is independent of these details, is that no reason has been given for thinking that a crowding-based

approach to gradability would not give rise to the exactly the kinds of silencing factors which Suchow and Alvarez report.[24] This of course presents an empirical challenge, namely to devise experiments which do discriminate between the two approaches to gradability. Such experiments could, at least given the various assumptions granted above, be potentially decisive in determining the tenability of the naïve view since, as I now explain, silencing poses no threat to naïve inheritance if the effect is graded in the alternative way I have outlined.

If a crowding-based approach to the gradability of motion silencing is correct, it is easy to handle silencing effects consistent with naïve inheritance. Imagine (leaving various complexities to one side) that at rotation speed *r*, a certain number *n* of the 100 dots escape crowding and so appear to change at their normal speed. The changes of the other 100–*n* dots are not perceived. With respect to the *n* escapee dots, there is no silencing: their colour changes are perceived and there is every reason to think that experience changes in a matching way. With respect to the 100–*n* dots whose changes are not perceived, we have a case of change blindness to be accounted for in just the way paradigmatic such cases were accounted for in Sect. 2. On one interpretation, the changes of the dots are indeed consciously perceived as such, yet because of crowding they are not conceptualized or encoded in explicit memory, and so are unavailable for report. On an alternative (and more natural) interpretation, the changes of the dots are not consciously perceived because of crowding. As a result there is no temporal property apparently presented, and so no prospect of a counter-example to naïve inheritance. Thus, insofar as the graded nature of silencing is a matter of increasingly large numbers of dots escaping crowding, silencing effects prove to be no more of a threat to naïve inheritance than familiar cases of change blindness. And that is to say no threat at all.

5 Failure to perceive change and perception of lack of change: a final objection

It might be objected, finally, that motion silencing differs from paradigm cases of change blindness in that, whereas in ordinary cases of change blindness we simply *fail* to perceive the changes of a changing object throughout some period (e.g., the colour changes of the wall in Simons' 'Monkey Business Illusion'), in cases of silencing we *positively misperceive* a changing object as remaining *unchanged* throughout some period. Given this, so the objection runs, naïve matching continues to be imperilled, since although apparently presenting a world unchanging in respect of colour, our colour experience in the rotation condition is fact changing rapidly.[25] This objection raises an important question concerning the perception (and apparent perception) of lack of change. However, although there is a clear sense in which we can perceive a lack of change (a sense which goes beyond merely failing to perceive the change), as I now argue, it does not support the objection just outlined.

[24] Note also that Suchow and Alvarez's subjects are not presented with stationary and rotating displays side-by-side, and only ever see a condition for 3 s at a time. This is not an ideal situation from which to compare the precise appearances of the displays.

[25] I'm grateful to an anonymous referee for pressing me to respond to this objection.

Dretske helpfully distinguishes 'two ways of understanding the perception of difference—as the perception of objects that differ versus the perception of the fact that they differ' (2004, p. 12). In Dretske's view, change blindness is not fundamentally a matter of failing to see change-events (though he certainly agrees that these are not seen), nor of failing to see objects that differ (he thinks these very plausibly *are* seen). Change blindness, according to Dretske, is fundamentally a matter of failing to see the *fact* that two scenes differ. To fail to see a difference in this 'fact' sense is to fail *to come to know* of a difference by use of the senses. Dretske emphasises that seeing facts is a form of visual perception, at least insofar as it is essentially and constitutively dependent on object-seeing. However, he also notes it is crucially different: for you can be blind to the fact that there is a difference and yet 'still see everything that is visible, everything out there in the world there is to see' (ibid., p. 15).

Consider, by analogy, the perception of *lack of difference*, or sameness. Here too we can distinguish two ways of understanding such perception. In the object sense, 'a sameness' refers to the objects and properties which constitute the sameness (e.g., the unchanged green of the dot). In this sense we may well see 'a sameness' or lack of difference without being in any way aware that the relevant object is unchanged. (Just as we can see a spy, to use Dretske's example, without being in any way aware that we have done so.) In contrast, in the fact sense, 'a sameness' refers to the fact that the dot's colour is unchanged. In this sense, perceiving a lack of change is a matter of *coming to know* of a lack of change by use of the senses (or more weakly of being in a position to know of a lack of change by use of the senses).

What about *apparently* perceiving a lack of difference? In the object sense, this would presumably involve misperceiving an object as green at two times when the object had in fact changed from green to red by the second time. This is not what is happening in cases of silencing (at least on the assumption granted above that one always perceives the dot's actual colour throughout the rotation condition). In silencing one does not perceive a lack of difference in the object sense—quite the opposite. What about the fact sense? Apparently perceiving a lack of difference in this sense would presumably involve a certain cognitive attitude, for instance of *coming to believe* of a lack of difference by use of the senses, or more weakly, of being inclined to so believe on the basis of one's visual experience. In silencing we plausibly *do* apparently perceive a lack of change or difference in this sense. Change blindness in general is striking precisely because we expect to be able to detect the large changes and differences presented to us, and yet spectacularly fail to do so.[26] In the case of silencing, we very naturally (though wrongly) assume that we will be able to detect any colour changes of bright, highly visible dots presented right before our eyes. This assumption is encouraged by the fact that we can clearly see their changes when there is no global rotation. As a result, when we fail to see any changes, we very naturally believe (or if we are wise to the facts, feel inclined to believe) that there have been no changes. As a result, it seems right to say that we apparently perceive a lack of change in the fact sense.

[26] On our lack of awareness of our limits in these respects see Levin et al. (2000, 2002).

Even though our experience itself is changing rapidly, apparently perceiving a lack of change in this fact sense poses no threat to naïve inheritance, however. Naïve inheritance is a thesis concerning the temporal properties apparently presented *in experience*. It does not speak to the contents of cognitive propositional attitudes, no matter how closely tied to experience. As a result, in neither object nor fact sense do we perceive a lack of change in a way which poses a difficulty for naïveté. What the objector needs is the idea that we can perceive an absence of change in the same way in which we perceive events of change, although absences of change are not positive events but rather negative failures to change. Many have questioned the very possibility of our perceiving such 'negativities'.[27] Yet, even if we think such a dismissal is too strong in general, it remains obscure why we should commit to such a form of awareness in the present case given that we seem able to capture all the variation amongst experiences in the terms drawn from Dretske as just discussed.[28] The objection is thus fundamentally incomplete and awaits defence of what we have now seen to be a very substantive assumption, namely that in cases of silencing we positively misperceive a failure of the dots to change.[29]

6 Conclusion

Watzl's aspiration to bring empirical findings to bear on philosophical issues concerning time consciousness is laudable. In the present case, however, his argument based on Suchow and Alvarez's motion silencing effects rests on a tendentious assumption about the way in which silencing is graded. I have argued that an alternative interpretation of silencing, as a novel form of change blindness, is

[27] Thus, O'Shaughnessy: 'Perception is as such of objects, events, qualities, and relations. It is of phenomenal realities. It is of phenomenal realities, and thus invariably of what one might call "positivities"' (2000, p. 332). I question this claim in its full generality in Phillips (forthcoming-b).

[28] Note further that the claim that we misperceive the dots as unchanging in the required sense is not established by insisting that the dots *look* or *appear* to be unchanging in the rotation condition. For instance, we might follow Martin (2010) and construe the appearance claim here as invoking an implicit comparison with the paradigmatic look of an unchanging display. The minimal commitment of holding that the dots *appear* to stop changing in the rotation condition will then be to the rotating display possessing a look which is relevantly similar to the characteristic look of a display of unchanging dots. This comparison does not commit us to our positively misperceiving the dots in the rotation condition. Indeed, the relevant similarity might simply amount to both displays failing to present us with change: something undoubtedly characteristic of unchanging displays.

[29] Watzl does consider the possibility of interpreting silencing as a novel form of change blindness (§5.4) but dismisses it on the ground that this would be to deny any phenomenological difference between stationary and rotation conditions. Here I think Watzl is misled by Dretske's focus on difference blindness and his somewhat curious view that change blindness is not strictly a form of blindness to change since the changes are 'concealed' (Dretske 2004, p. 16) or 'made invisible' (ibid., p. 3), whereas blindness is 'an inability to see visible things' (p. 6). In many cases of change blindness however there is a perfectly good sense in which the change events are visible (to an observer who didn't saccade just then, or who was attending to their location etc.), and so a perfectly good sense in which we can be said to be blind to visible change events. In cases of silencing the simple and dramatic phenomenal difference between rotation and stationary conditions is that in the former few if any (local) change events are seen, whereas in the latter many are.

available. This alternative interpretation is both empirically attractive and consistent with naïve inheritance. As a result, the naïve view of temporal awareness remains in place as our default account of temporal experience.

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