

## **Sensorimotor enactivism and temporal experience - (penultimate draft)**

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### **Sensorimotor enactivism**

The “sensorimotor” approach, first set out in O’Regan and Noë’s seminal paper “A sensorimotor account of vision and visual consciousness” (2001) and developed in recent sole-author accounts (e.g. Noë, 2004; O’Regan, 2011), offers a fresh take on perception that has already provided a basis for considerable further work both in philosophy and cognitive science.<sup>1</sup> The approach, labelled “enactivism” by Noë (2004), has something in common with the original enactivism of Varela, Thompson and Rosch (1991), after which it takes its name. Like that theory, and the more recent “radical enactivism” of Hutto and Myin (Hutto, 2005; Hutto and Myin, 2013), Noë and O’Regan’s “sensorimotor enactivism” rejects the role played by internal representation in traditional accounts of perception (e.g. Marr, 1982), urging instead that perception must be attributed to whole-body interactions between the agent and its environment.

Sensorimotor enactivism aims, in particular, to dislodge the idea that “somewhere in the brain an internal representation of the outside world must be set up which, when it is activated, gives us the experience that we all share of the rich, three-dimensional, colorful world” (O’Regan and Noë 2001, p. 939). To this end, the authors cite a wealth of empirical evidence indicating that we do not, as a matter of fact, process much detail at any given moment. O’Regan and Noë (henceforth O&N) (2001) point, for example, to work by O’Regan and others on the phenomenon of “change blindness”, where it has been found that subjects presented with a visual scene often fail to see

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<sup>1</sup> This paper focuses on the accounts outlined in O’Regan and Noë (2001) and especially Noë (2004). While they differ in several key respects, they have enough in common to group them under one broad approach, which I call either the sensorimotor approach or “sensorimotor enactivism”, following the usage of Hutto and Myin (2013).

objects - apparently in full view - disappearing, shifting or changing colour. In a similar vein, the authors point to work on “inattention blindness”, the phenomenon famously illustrated by Simons and Chabris’s (1999) “invisible gorilla” test. Here, subjects were asked to watch a short video of a basketball game and count the number of passes made by one of the teams; on being asked if they saw anything unusual, around half the subjects failed to report seeing that a woman in a gorilla suit walks through the scene.

Echoing Brooks’s (1991) line that the world serves as its “own best model”, O&N claim that the role played in traditional accounts by internal representation is instead played by the world itself, which serves as an “outside memory” (2001, p. 946). Perceivers access this “memory” by engaging in skillful bodily exploration of the environment. This aspect of the account reflects the “active vision” approach in computer vision, which similarly rejects the computationally-costly construction of detailed internal representations, in favour of embodied exploration of the outside environment (Ballard, 1991). If successful, the sensorimotor account provides a philosophical framework for this kind of approach.

One of the sensorimotor account’s most distinctive insights is that to engage in the relevant kind of bodily exploration, the perceiver must deploy its practical knowledge of “sensorimotor contingencies” (2001), the ways sense input, understood as informational input from the sense organs - and, in Noë (2004), as conscious appearance - changes in line with movements by the perceiver’s body or the object perceived. Difference in pattern of sensorimotor contingency is held by O&N (2001) to account for the qualitative differences in experience between modalities (for example vision and audition) and within each modality (for example the distinct looks of different colours and shapes). The main benefit of the thesis is that it truly *explains* these differences, where accounts that look for a “neural correlate of consciousness” (p. 940) leave an irresolvable explanatory gap: “Surely the choice of a particular subset of neurons or particular cortical regions cannot, in itself, explain why we attribute visual rather than auditory qualities to this [retinal] influx. We could suppose that the neurons involved are of a different kind, with, say, different neurotransmitters, but then why and how do different neurotransmitters give rise to different experiences?” (p. 940).

Differences between modalities are accounted for by those patterns of sensorimotor

contingency that are modulated by characteristics of the perceiver's body:

"[W]hen the eyes rotate, the sensory stimulation on the retina shifts and distorts in a very particular way, determined by the size of the eye movement, the spherical shape of the retina, and the nature of the ocular optics [...] auditory sensorimotor contingencies have a different structure. They are not, for example, affected by eye movements or blinks. They are affected in special ways by head movements: rotations of the head generally change the temporal asynchrony between left and right ears" (O&N, 2001, p. 941).

Meanwhile, differences within each modality are accounted for by object-related sensorimotor contingencies. For example, the visual quality of a shape "is precisely the set of all potential distortions [from our perspective] that the shape undergoes when it is moved relative to us, or when we move relative to it. Although this is an infinite set, the brain can abstract from this set a series of laws" (O&N, 2001, p. 942).

Sensorimotor enactivism can be delineated, in summary, by the following four theses:

**The Embodiment thesis:** Conscious perceptual experience depends (perhaps constitutively) not just on the brain but also on extra-neural bodily interactions with the outside environment. "There is no *'re'*-presentation of the world inside the brain: the only pictorial or 3D version required is the real outside version" (O&N, 2001, p. 946); "experience frequently makes use of temporally extended, dynamic access to the world" (Noë, 2004, p. 218), hence, "the physical substrate of the experience *may* cross boundaries, implicating neural, bodily and environmental features" (Noë, 2004, p. 221).

**The Understanding thesis:** Conscious perceptual experience depends, constitutively, on the perceiver's "implicit practical knowledge" (Noë, 2004, p. 117) or "mastery" (O&N, 2001, p. 943) of sensorimotor contingencies.

**The Sensorimotor Contingency thesis:** Phenomenal qualities are accounted for by the distinct ways sense input changes in line with movement by the perceiver or the object perceived. "[A] crucial feature that contributes to what it is like to see is the fact that objects, when explored visually,

present themselves to us as provoking sensorimotor contingencies of certain typically visual kinds, corresponding to visual attributes such as color, shape, texture, size, hidden and visible parts” (O&N, 2001, p. 944).

**The Skill-Based Access thesis:** In a momentary act of awareness, you never consciously experience any complete object or property (Noë, 2004, p. 135), but, due to your possession of sensorimotor understanding, experience perceptual detail as “accessible” (Noë, 2004, p. 215).

Kelly (2005) observes that any theory of perception must solve a puzzle concerning the direct experience we seem to have of temporally extended events. Clark (2006), making use of Kelly’s example, implies that the sensorimotor approach may be compromised altogether by its own unique difficulty accounting for temporal experience. This paper aims to show the direction a sensorimotor enactivist response to temporal experience ought to take and, at the same time, defend the account from the charge that it fails altogether because it is unable to adequately meet the challenge temporal experience poses. Further, the paper aims to show how adopting a particular approach to event perception has an interesting bearing on how the sensorimotor enactivist should explain object perception, too.

In the next section, I discuss the puzzle of temporal experience as it applies to all theories of perception, and the debate over temporality between Noë and Clark. In the third section, I discuss a tension between the ascribed roles of bodily coupling and knowing in sensorimotor enactivism, and argue that this tension should be resolved in a particular way to account for temporal experience. In the fourth section, I discuss the Skill-Based Access thesis, and argue that this too should be reformulated on the lines of my current proposal. In the fifth section, I indicate how the sensorimotor enactivist could provide a unified account both of object and event perception.

### **Temporal experience**

The puzzle of temporal experience (Kelly, 2005) concerns perceptual awareness of temporally extended phenomena like change, succession and constancy. To illustrate, Kelly offers the example of an opera singer delivering a sustained note. When you hear it, your experience incorporates not just

the note's immediate presence, but also, somehow, its extended temporal duration:

There you are at the opera house. The soprano has just hit her high note – a glass shattering high C that fills the hall – and she holds it. She holds the note for such a long time that after a while a funny thing happens: you no longer seem only to hear it, the note as it is currently sounding [...] in addition, you also seem to hear something more [...] the note now sounds like it has been going on for a very long time [...] What you hear no longer seems to be limited to the pitch, timbre, loudness and other strictly audible qualities of the note. You seem in addition to experience, even to hear, something about its temporal extent. (Kelly, 2005, p. 208)

Grush (2007) offers another example of temporal experience, this time concerning motion. Imagine you are looking at a clock. However long you stare at the hour hand, you never *see* it move, although you can infer it has moved. When you look at the second hand, however, you seem to directly perceive its motion as it moves around the clock face. Temporal experience is a *puzzle*, as Kelly (2005) puts it, rather than a mere *problem*, because it involves an apparent paradox: What you perceive now, at this moment, ought only to be what is present now. Motion, change and duration are not momentary, but take place over extended periods of time. Solutions to the puzzle will differ in their diagnosis of what is happening when you hear the opera singer, or look at the second hand, but the examples show clearly that there is some datum to be explained.

Dainton (2010) places proposed solutions into three distinct categories. The “cinematic” approach is the view that perceptual experience is divided into static snapshots, like a cinema reel. On this approach, what you perceive at a given instant is just what is present at that instant, meaning you *cannot* right now literally experience a temporally extended event. Temporal experience, here, has to be explained some other way. Crick and Koch (henceforth C&K) (2003), for example, suggest that you do not experience motion, but “a series of static snapshots, with motion ‘painted’ on them” (p. 122); they suggest, by analogy, that the experience of motion has something in common with the motion suggested by a drawing of a person in mid-stride (p. 122, fig. 1). The other two camps, by contrast, endorse the existence of what James (1982) called the “specious present”, an experiential ‘now’ that really does have duration. The “retention-protention” approach (Dainton, 2010), of which Husserl (1991) and, under Husserl’s influence, Varela (1999) were notable exponents, says that the experience of what is genuinely present at a given instant is accompanied by “retentions” from the immediate past and/or “protentions” into the future; these can be understood, respectively, as special

sorts of memory and anticipation deployed in perception. The “extensional” approach (or “extensionalism”) - endorsed, for instance, by Dainton (2000) - says that the *content* of the perception (the state of affairs represented by the experience) temporally tracks the *vehicle* (the physical state that realises the experience). Dainton (2010) observes that on this view, since “our episodes of experiencing are themselves temporally extended, [they] are thus able to incorporate change and persistence in a quite straightforward way”.

Clark (2006) uses temporal experience - in particular, Kelly’s opera singer example - to expose what he regards as a flaw with sensorimotor enactivism as a general account of perception. His argument asserts that temporal experience poses a problem, in particular, for Noë’s Skill-Based Access thesis, the view that you fail to experience the objects of perception as straightforwardly “present”, but instead experience them as “accessible”, thanks to your possession of sensorimotor understanding. I will not dwell yet on the distinction between simple presence and presence-as-accessibility, but simply highlight that the Skill-Based Access thesis itself rests on the Sensorimotor Understanding and Sensorimotor Contingency theses, and that these views are themselves implicitly targeted by Clark’s objection. He says we cannot explain the experience of the opera singer’s note “by appeal to any sense of the potential availability of the missing parts of the temporally extended sound stream, nor can we know (indeed, it is barely intelligible to ask) how those missing parts of the soundstream would vary or come into focus as we move our head or body” (Clark, 2006, p. 23). Since the past and future are not, in other words, mediated now by laws of sensorimotor contingency, it cannot be sensorimotor understanding that explains the experience of the note’s duration.

Noë’s (2006) response agrees that sensorimotor understanding only explains object perception, arguing that this does not compromise the sensorimotor theory in general. He suggests that since event perception is, in any case, a quite different species to object perception, his approach is not committed to giving a sensorimotor account of the opera singer case. He justifies this by reference to the distinct qualitative character of object experience and the experience of the note’s duration: “it rides roughshod over the phenomenology [...] to say that the past sounds [like objects] are now present or that they are *now accessible*” (p. 28); instead, he claims, you hear the note “as

having a certain *trajectory* or *arc*, as unfolding in accordance with a definite law or pattern” (p. 29).

Noë’s positive account of the opera singer case posits that we have a (non-sensorimotor) grasp of where the note is coming from, analogous to linguistic understanding:

When you hear the singer’s sustained note, you do not experience the acoustical properties of the sound, anymore than you experience the acoustical properties of the words you hear when you understand speech. In the linguistic case, you hear meanings themselves, you hear what is said. In the case of the singer, what you actually hear is the singer herself, her voice, her vocal action – what she is doing. It is the fact that the singer is doing something, performing an action, that fixes the relevant temporal horizon and intentional arc. (Noë, 2006, p. 29)

This offers a solution to the temporal experience puzzle akin, in important respect, to Crick and Koch’s cinematic account. Where Noë claims that different kinds of knowledge are responsible for object experience and temporal experience, C&K (2003), similarly, ascribe these to separate “mechanisms” (p. 122). Moreover, both C&K and Noë agree that you do not experience temporally extended phenomena *directly*. As with Noë’s invocation of an experienced *trajectory*, C&K suggest motion is “‘painted’ on” (p. 122) to static snapshots, resulting in your experiencing moving objects as being *in* motion, while failing to *directly experience* that motion.

However, Noë maintains that even temporal experience involves a *coupling* with the environment rather than a *representing*:

[P]erception is an activity of sensorimotor coupling *with the environment* [...] experiences are not acts [...]; they are not representations; they are *activities*, events themselves; they are temporally extended patterns of skillful engagement. When you perceive an event unfolding, it is not as if you occupy a dimensionless point of observation. You *live through* an event by coupling with it. (Noë, 2006, p. 31).

This suggests a quite different line of response than the one endorsed by the linguistic analogy. Extrapolating from Noë, the thought seems to be that the physical substrate of the experience is a smoothly continuous activity rather than one which breaks down into temporally discrete chunks: hence to explain the physical substrate of perception, one must look at dynamically unfolding interactions, rather than “object”-like structures in the brain. If we appended to this the extensionalist view that the content of an experience temporally tracks the activity of experiencing, it would mean that the content of experience is always, itself, temporally extended. Notably, this does not need to entail that past and future portions of the note should be experienced as now present.

Rather, it here may suggest - as Noë claims - that to experience the world is to experience being in the midst of some trajectory.

### **Coupling and knowing in temporal experience**

The debate over temporal experience speaks to a broader tension within sensorimotor enactivism. As many commentators have noted, the approach sometimes appears to stipulate that the temporally extended *bodily exercise* of sensorimotor knowledge is required; at other times, it apparently suffices that the perceiver merely *possesses* sensorimotor knowledge. Aizawa (2010) terms these variants, respectively, “Strong Enactivism” and “Weak Enactivism”. We could usefully contrast these with Hutto and Myin’s “Radical Enactivism” (2013), which abandons the notions of “content” and “knowledge” altogether, in favour solely of their “Strong Embodiment” view that perception is “literally constituted by, and to be understood in terms of, concrete patterns of environmental situated organismic activity, nothing more or less” (p. 11). I will not address the Radical Enactivist position in detail here, but point out, for now, that my arguments in favour of Strong Enactivism take the position closer, at least, to this line.

Noë’s discussion of temporal experience betrays a similar tension: while its main claim is that the experience of duration is explained by your understanding of what you are hearing, it indicates a quite different line of response when it argues that hearing the note involves, in any case, a temporally extended *coupling* with the environment. The tension is particularly stark in the case of event perception, because it is hard to see why temporal experience should be explained by understanding *and* coupling. In the original story about object perception, sensorimotor knowledge is sometimes glossed as knowing-how to act, for example when O&N (2001) suggest sensorimotor knowledge is comprised of “action recipes” (p. 945) or when Noë (2004) says: “[t]o experience [an object] as on the left is to experience it as necessitating [...] various possibilities of sense-affecting movements” (pp. 87-88). Here, we can readily grasp that perception might involve, vitally, a temporally extended process of bodily coupling, itself mediated by sensorimotor knowledge. By contrast, your knowledge of where the opera singer’s note is coming from may be implicit, but there is no obvious way in which it is *practical*, or geared toward action, as sensorimotor knowledge might

be. If it is not practical, but, as Noë suggests, more like linguistic comprehension, then it is hard to see why possessing or exercising this knowledge should entail, in any interesting sense, a *coupling* with the environment rather than just a *representing* of the environment. The sensorimotor theorist, in the temporal case, no longer has an obvious response to the theorist who maintains that neural states or structures *alone* are the interesting, indeed constitutive, features underlying conscious perceptual experience.

This threatens to undermine sensorimotor enactivism, as it means Weak Enactivism, on the current diagnosis of temporal experience, can no longer sustain any of the theory's main tenets. The Embodiment thesis is ruled out, since bodily movement is not required for perceptual experience. The Sensorimotor Contingency, Sensorimotor Understanding and Skill-Based Access theses are, at best, only partly right, because they account only for object experience, not temporal experience. The sensorimotor enactivist could respond that although event perception is non-sensorimotor, it depends for its existence on object perception, which is sensorimotor. Conceding this much, however, gives the opponent room to deny that perception is intrinsically sensorimotor *at all*. Clark (2008), for example, claims that perception is a matter of sensorimotor *summarising* - the extraction of information about sensorimotor contingencies, along with other information, for the construction of representations that are not themselves finely sensitive to the sensory effects of possible movements (pp. 190-193).

Therefore, I propose that the sensorimotor enactivist should drop Noë's analogy with linguistic understanding and stick, instead, to an extensionalist story, which says that event experience is explained by a particular kind of temporally extended coupling with the environment. This will require, at least for the temporal case, adopting either Radical or Strong Enactivism. The mere *possession* of sensorimotor understanding would not be sufficient to explain the experience of duration, since duration is not a matter of sensorimotor contingency. However, the bodily exercise of sensorimotor understanding takes time anyway: so, if we assume the content of experience temporally tracks the vehicle, the experience of duration comes for free. This suggestion is not merely a get-out clause, but fits the phenomenology - the experience of trajectory - aptly described by Noë. It explains why your experience, now, of the opera singer's note sounds like it is part of something

temporally extended.

### **Object experience and skill-based access**

I have suggested that the best response the sensorimotor enactivist can make to Clark's objection from temporal experience is to argue that temporally extended content supervenes on a temporally extended vehicle, comprised of skill-driven bodily coupling with the environment. This precludes Weak Enactivism about event experience. The sensorimotor enactivist could, conceivably, endorse this, but endorse Weak Enactivism for object experience. In this case, the debates over temporal experience and Weak- versus Strong Enactivism would come apart. My proposed version of extensionalism, however, accounts for object perception as well as event perception. This results from what I contend is the most productive way to understand and make use of the Skill-Based Access thesis, and it is this thesis I turn to now.

Noë (2004) outlines skill-based access when he likens perception to accessing a newspaper via the World Wide Web. He points out that when you view the online version of the New York Times, your computer does not download the day's edition all at once, but downloads, on request, one article at a time. This is sensible, as it limits the burden placed on your computer and internet connection, and means that should an article be updated, you get the latest version. Importantly, accessing the paper in this piecemeal fashion is, for all intents and purposes, just like having the whole issue there at once, since every article is accessible as needed. The day's edition is available, as Noë puts it, *virtually*. Seeing, Noë suggests, works in a similar way. You do not experience, all at once, a richly detailed visual field. Instead, you access, as required, detail available from the outside environment. The presence of rich detail is also, in this sense, virtual (Noë, 2004, pp. 49-51).

However, in a crucial disanalogy with the computer case, Noë claims that perceptual presence is "virtual *all the way in*" (2004, p. 134). The suggestion is apparently that no complete property is ever present to experience in a local or offline manner: a claim Noë argues is justified by attention to one's own experience: "A perceptual experience doesn't analyze or break down into the experience of atomic elements, or simple features [...] the moment you stop and try to make a specific feature the sole object of your consideration - *this shade of red*, for example - it slips away

from you in the sense that it exceeds what you can take in, in completeness, in an instant” (2004, p. 135).

This is a puzzling sort of claim. There is (I think - and the reader might accept, at least for the sake of argument) something in Noë’s phenomenological claim that you cannot, in a momentary act, get a visual grasp of any complete property, such as a shade of red. However, there is certainly *something* it is like to see a red thing. Noë (2004) explains this by claiming that properties are “present not *as represented*, but *as accessible* [...] [t]hanks to my possession of sensorimotor skills” (p. 215). As he puts it in a later piece, the environment “shows up as present, but out of view, in so far as I understand that I am now related to it by familiar patterns of motor-sensory dependence. It is my basic understanding of the way my movements produce sensory change given my situation that makes it the case, *now, even before I have moved an inch*, [emphasis added] that elements outside focus and attention can be perceptually present” (Noë, 2009, p. 474). This view is a Weak Enactivist position, since it stipulates that no movement or temporal extension is required. As a result, the perceptual experience described must be the result of an internal state, plausibly an internal representation specifying what movements the perceiver should make to bring objects into view.

It is not obvious, however, why this sort of sensorimotor understanding should not allow a perceiver at some instant to take in an atomic visual feature, given visual features are meant to be specifiable by reference to movement-related contingencies. We could make sense of this by supposing that the sensorimotor knowledge made use of by the perceiver at a given moment fails to correspond, precisely, to any atomic feature, such as a shade of red. If this were true, however, it would not be clear how we can explain the fact that perceivers experience shades of red at all. As I result, I contend that the best way to make sense of the computer metaphor, and the associated phenomenology, is to hold that object experience, like event experience, supervenes on a temporally extended material realiser. In other words, the extensionalist proposal is useful as a way to characterise both event and object perception. I elaborate on this in the next section.

### **Extensionalism about event and object experience**

It is beyond the scope of this paper to consider the merits and demerits of various approaches to

temporal experience independent of their relation to sensorimotor enactivism. I argue, however, that extensionalism is likely to provide the right conceptual foundation for a sensorimotor enactivist response to temporal experience. Adopting this approach is useful for the sensorimotor enactivist, because it allows the theorist to respond convincingly to the specific challenge set by Clark (2006), and thereby save the approach from the danger that it fails altogether because it is unable to account for temporal experience. More significantly, there is good reason to endorse the extensionalist claim that perceptual content temporally tracks a temporally extended vehicle anyway, since it has the added utility of offering a new and better way of explicating some of the compelling claims made by the Skill-Based Access thesis. On my proposal, event and object experience are not only explained the same way, but are aspects of the same phenomenon.

An extensionalist sensorimotor account, in the first place, explains temporal experience by positing that perceptual awareness of a temporally extended event supervenes on a temporally extended process of interaction between the perceiver and the environment, in such a way that the content temporally tracks the vehicle. This is, in principle, compatible with the view that *object* experience is explained by the mere possession of sensorimotor knowledge, a Weak Enactivist thesis. However, we could plausibly go further and suppose that the characterisation of object experience found in the Skill-Based Access thesis can best be explained by accounting for object experience in the same way as event experience.

An initial move is to reject any suggestion that knowing the movements you could make to bring an object into view can amount, by itself, to entertaining perceptual content about that object. Instead, the mere possession of sensorimotor knowledge might enable, more modestly, a nonspecific feeling that there is detail available which can be accessed from the environment as needed (as suggested by Clark, 2008, p. 194). To account for perceptual content - corresponding to an opera singer's note, or a shade of red - I suggest we instead point to the perceiver's skillful coupling with an environment in which the relevant laws of sensorimotor dependence apply.

Suppose, for the sake of argument, that this is a correct account of object experience. Combined with the extensionalist claim that the content of perceptual experience temporally tracks the vehicle, it would follow that the content of object experience is itself temporally extended. This is

counterintuitive, but compelling if you consider the Skill-Based Access thesis in a particular light. Recall two of the claims that the thesis incorporates. There is a phenomenological claim, concerning a perceiver's inability to experience, in a momentary act, any atomic visual features. There is also a claim about the material substrate of experience, captured by Noë's discussion of virtuality, which suggests that perception is entirely beholden to the agent's online interaction with the environment. Neither of these claims are indisputable, but they are coherent accounts of how perception may work. If you think there is something right about the Skill-Based Access thesis, extensionalism about object experience offers a way to make sense of it. On the view I recommend, one cannot, in a momentary act, take in a shade of red for the *very same* reason that one does not experience, at this instant, the past and future portions of the opera singer's high C. Perceptual experience, both of objects and events, supervenes on something that may, essentially, be understandable only by reference to a temporally extended, dynamical process.

Noë's (2004) claim that experience is "virtual *all the way in*" (p.134) could suggest that the spatial size of the visual field is infinitesimally small or even non-existent. This makes the sensorimotor account sound like it denies perceptual experience altogether. A better gloss on the claim says that experience is virtual *all the way in* not, primarily, because the information processed at one time by the visual system is minimal - although it may be minimal - but because this information can *only* be processed in the course of temporally extended coupling with the outside environment. To revisit the World Wide Web analogy: if your access to the online newspaper were virtual *all the way in*, a faulty understanding of virtuality would suggest that your computer "knows" how to access the internet, but has no screen with which it can locally display a web page. According to my gloss, however, the computer has a screen, but loses its ability to display any web page - even one you already have open - the instant it loses its connection to the Internet. It is a commonplace that perception, ordinarily, requires that there is an environment present to perceive. However, the point of virtuality, as currently understood, is to show that ongoing dynamic interaction with the environment is a conceptual *necessity* for perceptual experience.

An upshot of this view is that perceptual content can only supervene on a temporally extended vehicle, and never on a momentary state. This goes part way to accounting for the

experiential quality that Noë observes accompanies skill-based access, namely the inability to fixate, at an instant, on any atomic visual feature. Note, however, that the content of an experience need not temporally track the material realiser. If it does not, a temporally extended vehicle could yield the experience of an instant in time in which you take in a shade of red. The extensionalist view that the content does temporally track the vehicle has the benefit of offering an apt way to reformulate the phenomenological account offered by Noë. The inability to take in a shade of red in what you *experience* as a durationless instant is explained by the fact that having an experience of red is, in part, having an experience of duration. A visual feature never feels phenomenally present *at this instant* because, before you have a chance to fixate on it, the relevant detail has lapsed from being something that you are confronted with now, to something that you have been confronted with a moment ago. Extensionalism, here, allows that you can experience a shade of red, but stipulates that this takes place - and is experienced as taking place - over an interval of time. The process is likely to be assisted if your movements during that time help you gain information about the patterns of sensorimotor contingency that currently hold between your body and the environment.

Returning now to the debate between Clark and Noë, Clark's objection to skill-based access is that elapsed portions of the opera singer's note are not accessible now, hence your experience of them cannot be explained by means of their accessibility. Noë's response denies that object and event experience need to be explained in the same way, on the grounds that they are different species of awareness: "*objects* are primary in our experience [...] experience of events depends on a more basic sensitivity to the presence of objects" (Noë, 2006, p. 31). I have earlier argued that Noë's line of response may be inadequate to defend the central tenets of sensorimotor enactivism. This drawback can be avoided, I now argue, precisely by reversing Noë's claim, and contending that the experience of objects depends on the ongoing conscious presence of events that have been occurring moments into the past.

## **Conclusion**

Given the influential character of Noë and O'Regan's work, it is a matter of some importance that the approach has the resources to provide a plausible answer to the puzzle of temporal experience.

Noë (2006) offers an ambivalent response. He suggests, briefly, that it can be explained by temporally extended “coupling”. As I have argued, however, there are no obvious grounds to endorse this, given his main claim that the experience of the opera singer’s note is explained by an understanding, akin to linguistic comprehension, of where the note is coming from. While this latter claim provides an account of temporal experience, it entails an abandonment of the four central tenets that I mentioned in the introduction, as far as event experience goes. In so doing, it renders the theory more vulnerable to the objection that object perception is not fundamentally sensorimotor either, expressed, for example, by Clark (2008), when he espouses sensorimotor summarising.

With the purpose of defending sensorimotor enactivism, I have aimed to indicate the conceptual foundation of a sensorimotor enactivist account of temporal experience. This involves rejecting the language analogy and emphasising temporally extended activity. Adopting extensionalism as a working hypothesis invites, in turn, a particular understanding of object experience. This is worth endorsing in its own right because of the useful gloss it places on Noë’s otherwise compelling “virtuality” metaphor, and its attendant phenomenology. This consideration thereby gives the sensorimotor enactivist even more reason to pursue extensionalism as an explanation of temporal experience.

Clark’s (2006) critique has the salutary effect of forcing the endorser of sensorimotor enactivism to evaluate carefully the respective roles of coupling and knowing in the approach. If my recommendations are right, knowledge only plays a role if it is directly implicated in bodily coupling with the environment. If bodily interaction is key, then temporal extension is also surely vital. Hence, the sensorimotor enactivist should do more than pay lip service to temporality, but take into serious account the temporally extended nature both of perceptual experience and its material substrate.

## Works cited

- Ballard, D. (1991). Animate vision. *Artificial Intelligence*, 48, 57 – 86.
- Brooks, R. (1991). Intelligence without representation. *Artificial Intelligence*, 47, 139 – 59.
- Clark, A. (2006). That Lonesome Whistle: A Puzzle for the Sensorimotor Model of Perceptual Experience. *Analysis*, 66(289), 22–25.
- Clark, A. (2008). *Supersizing the Mind: Embodiment, Action, and Cognitive Extension*. Oxford: Oxford University Press.
- Crick, F., & Koch, C. (2003). A framework for consciousness. *Nature Neuroscience*, 6(2), 119 – 126.
- Dainton, B. (2000). *Stream of Consciousness*. London: Routledge.
- Dainton, B. (2010). Temporal Consciousness. *The Stanford Encyclopedia of Philosophy, Fall 2010 Edition*. Internet Encyclopedia. Retrieved from <http://plato.stanford.edu/archives/fall2010/entries/consciousness-temporal/>
- Grush, R. (2007). Time and experience. In T. Müller (Ed.), *The Philosophy of Time*. Frankfurt: Klosterman. Retrieved from <http://mind.ucsd.edu/papers/time&exp/time&exp.pdf>
- Husserl, E. (1991). *On the Phenomenology of the Consciousness of Internal Time (1893-1917)*. (J. B. Brough, Trans.) Husserliana: Edmund Husserl - Collected Works (Book 4). Dordrecht: Kluwer.
- Hutto, D. (2005). Knowing what? Radical versus conservative enactivism. *Phenomenology and the Cognitive Sciences*, 4(4), 389–405.
- Hutto, D., & Myin, E. (2013). *Radicalizing Enactivism: Basic Minds without Content*. Cambridge, Mass.: The MIT Press.
- James, W. (1981). *The Principles of Psychology*. Cambridge, Mass.: Harvard University Press. Originally published in 1890.
- Kelly, S. (2005). The Puzzle of Temporal Experience. In A. Brook & K. Akins (Eds.), *Cognition and the Brain: The Philosophy and Neuroscience Movement* (pp. 208-238. Cambridge, UK: Cambridge University Press.
- Marr, D. (1982). *Vision. A Computational Investigation into the Human Representation and Processing of Visual Information*. New York: W.H. Freeman and Company.
- Noë, A. (2004). *Action in Perception*. Cambridge, Mass.: The MIT Press.
- Noë, A. (2006). Experience of the World in Time. *Analysis*, 66(289), 26–32.

Noë, A. (2009). Conscious Reference. *The Philosophical Quarterly*, 59(236), 470 – 482.

Noë, A. (2012). *Varieties of Presence*. Cambridge, Mass.: Harvard University Press.

O'Regan, J. K. (2011). *Why Red Doesn't Sound Like a Bell: Understanding the feel of consciousness*. Oxford: Oxford University Press.

O'Regan, J. K., & Block, N. (2012). Discussion of J. Kevin O'Regan's "Why Red Doesn't Sound Like a Bell: Understanding the Feel of Consciousness." *Review of Philosophy and Psychology*, 3(1), 89 – 108.

O'Regan, J. K., & Noë, A. (2001). A sensorimotor account of vision and visual consciousness. *Behavioral and Brain Sciences*, 24(24), 5.

Simons, D., & Chabris, C. (1999). Gorillas in our midst: sustained inattention blindness for dynamic events. *Perception*, 28, 1059 – 1074.

Varela, F. (1999). The Specious Present: A Neurophenomenology of Time Consciousness. In J. Petitot, F. Varela, B. Pachoud, & J.-M. Roy (Eds.), *Naturalizing Phenomenology: Issues in Contemporary Phenomenology and Cognitive Science* (pp. 266–329). Stanford: Stanford University Press.

Varela, F., Thompson, E., & Rosch, E. (1991). *The Embodied Mind*. Cambridge, Mass.: The MIT Press.