

SHOWTIME AT THE CARTESIAN THEATER? VEHICLE EXTERNALISM AND DYNAMICAL EXPLANATIONS

Abstract: Vehicle externalists hold that the physical substrate of mental states can sometimes extend beyond the brain into the body and environment. In a particular variation on vehicle externalism, Susan Hurley (1998) and Alva Noë (2004) have argued that perceptual states, states with phenomenal qualities, are among the mental states that can sometimes spread beyond the brain. Their vehicle externalism about perceptual states will be the main topic of this article. In particular, I will address three strong objections to their vehicle externalism, objections by Ned Block (2005), Jesse Prinz (2006), and Fred Adams & Ken Aizawa (2008). Though in some ways these objections appear disparate, I will argue that all of them depend on a crucial presupposition, one which Hurley, Noë, and their sympathizers should reject. This presupposition is that perceptual character is fixed by an instantaneous snapshot of neural states, a view that Hurley dubbed 'temporal atomism.' To put the presupposition in more familiar terms, all three objections are implicitly committed to something like Dennett's Cartesian Theater (1991). In the first part of the article, I will discuss Hurley and Noë's views, and include reasons why their views entail the rejection of the Cartesian Theater. In the next part of the article I will introduce the three objections and show how they presuppose something like a Cartesian Theater. I will also show that, if the Cartesian Theater is rejected, the objections all vanish. In the final part of the article I address the charge that Noë and Hurley confuse causation with constitution. This charge reveals a lack of appreciation for the way in which dynamical explanation motivates Hurley's externalism.

Introduction

The format of some contemporary academic philosophy -- attack, parry, riposte -- can obscure the fact that philosophy occurs within a tradition. Thinkers are influenced by,

and an influence on, other thinkers. In this article I highlight the importance of a main philosophical influence behind a particular strain of externalism about the mind. In particular, I will show how externalism about the vehicles of perceptual states owes a great debt to Daniel Dennett's critique of Cartesian Materialism. The fact that there is a link between this kind of externalism, on one hand, and Dennett's work, on the other, is itself perhaps no news. But this link is not merely of interest for the historian of turn of the millennium philosophy of mind. Rather, as I hope to show, some of the most important attacks on this strain of externalism lose some of their edge, as it were, when properly placed into a Dennettian context.

The strain of externalism that I will discuss here has been most prominently developed by Susan Hurley and Alva Noë, both individually and in collaboration. Much of the critical reaction has been to Noë's, rather than Hurley's, work. As I hope to show, though, a proper understanding of this kind of externalism requires a consideration of Hurley's work as well. I take it that the position at issue is something like the following:

Externalism about the Vehicles of Perceptual States (EVPS): The vehicles of human perceptual states sometimes include the body and environment in addition to the brain.

Note that the perceptual states mentioned in the formulation of EVPS are meant to be states with phenomenal character. Thus, EVPS is distinct from, though not necessarily in conflict with, vehicle externalism about the *content* of mental states (Clark & Chalmers 1998, Clark 2008).¹

In the first part of the article I will outline the basic motivation for EVPS with an emphasis on its connection with Dennett. In the second part of the article I will first present three strong objections to EVPS, objections from Ned Block (2005), Jesse Prinz

¹ See Hurley (2010) for the different types of externalism to be found in the literature.

(2006), and Fred Adams & Ken Aizawa (2008). Then I will show how all three of these objections depend on a commitment to what Susan Hurley called 'temporal atomism.' It is this way of understanding perception that overlooks the basic Dennettian insights which motivate EVPS, especially the insight into the problematic nature of the Cartesian Theater. If we reject the presupposition, all three objections vanish. In the final part of the article I will make some remarks about the charge that EVPS commits a fallacy in confusing constitution with causation.

I. The Roots of Vehicle Externalism

In a revealing passage, Hurley makes the following claim:

Temporal extension leads to spatial extension; Dennett (1991) famously made the intracranial version of this point in his arguments against a Cartesian theater, but the point extends promiscuously across the boundaries of skull and body. (2010: 111)

This passage illuminates what I consider to be the key insight behind EVPS. If we take Dennett's point about the Cartesian Theater, and if we look without prejudice at the spatial and temporal properties of the causal interactions which enable perceptual experience to occur, then we are led, quite naturally, to EVPS. Or at least that's what I hope to make clear in this first section of the article. First I will sketch the relevant points made by Dennett, then I will discuss Hurley's appropriation of those points, and how they motivate EVPS.

The assault on the Cartesian Theater as a way of thinking about consciousness is a main theme in Dennett's *Consciousness Explained*. It would be beyond the scope of this article to give a full treatment of the topic, but here is the basic idea. According to Dennett,

Cartesian materialism is the view that there is a crucial finish line or boundary somewhere in the brain, marking a place where the order

of arrival equals the order of presentation in experience because
what happens there is what you are conscious of. (1991: 107)

A corollary of Cartesian Materialism is belief in the Cartesian Theater, which is that place in the brain where "it all comes together." (107).

Hurley suggests that the assumption of the Cartesian Theater leads to the related assumption of temporal atomism. Temporal atomism about consciousness is the idea that there is a determinate conscious experience at each instant which is "carried by subpersonal processes moment by moment, snapshot by snapshot" (Hurley, 1998: 31). The alternative to temporal atomism is the notion that subpersonal vehicles are essentially dynamic as carriers or enablers of content. That is, a static physical configuration may not be the kind of thing that can serve as a vehicle of phenomenal character.

Now we can begin to see the connection between Dennett and EVPS. Suppose, along with Dennett and Hurley, that there is no Cartesian Theater, and that temporal atomism is false. Perceptual experience is inherently temporal, and the vehicles of that experience are temporally extended. Is it true, as Hurley suggested, that temporal extension leads to spatial extension? Taken as a universal claim, I suppose it is false. The repeated firing of a neuron has temporal extension but the space taken up by the neuron remains relatively static. Though not universally true, the claim is true under a more charitable interpretation. The more charitable way to understand Hurley's claim is as an empirical claim about the causal structure of the human body and nervous system.

If physical structures serve as vehicles because of their dynamics, then it is reasonable to consider the causal structure which enables the dynamics. If we do so, we find multiple feedback loops, loops which occur at different time scales and involve physical structures both internal and external to the organism. Hurley sums it up as follows:

If we track the causal arrow through time, such a complex dynamic feedback system looks like a tangle or knot, centered on the organism and moving with it: a singularity in the field of causal flows. (1998: 307)

Temporal extension leads to spatial extension if we follow the causal flow over time. Again, this insight is motivated by an honest empirical look at the brain and behavior -- in contrast to 'common sense' intuitions. It is uncontroversial that neural wiring is bi-directional, and there is evidence that feedback connections are more plentiful than feedforward connections in cortex (Liu et al. 1995). In addition, the brain continuously receives feedback from causal loops which include the body as well as parts of the environment (Hurley 1998, chapter 10). *If* it turns out that it is best to include these loops in explanations of perception and intelligent behavior, then EVPS looks plausible.

This claim about following the causal flow should not be misunderstood. If I fire a pistol, the causal impact of doing so would extend in space for the trajectory of the bullet and perhaps beyond. It would not be right to say that, according to Hurley, my intention to fire the pistol extends the entire distance traveled by the bullet. Why not? First, because my intention to fire the bullet is not causally impacted by any direct feedback from the bullet in flight. Second, because any causal impact of the fired bullet on my neural processing (through perception) would be irrelevant for a good psychological explanation of my intention to fire the pistol. Firing a pistol is a discrete act. Many of our activities, in contrast, are continuous and ongoing, and do indeed involve feedback loops, both internal and external.

If we reject temporal atomism and trace the causal route of perceptual and motor processes, then we find spatial extension in the form of multiple feedback loops. From Dennett, we arrive at EVPS.

II. Three Objections, One Presupposition

Now that I have shown the connection between Dennett's work on consciousness and EVPS, I will turn to three main objections to EVPS. In this section of the article I will explain how all of these objections presuppose something like the Cartesian Theater, or the related commitment of temporal atomism.

The first objection comes from Ned Block's review of Alva Noë's *Action in Perception*. In particular, Block is interested in the minimal supervenience base of perceptual experience. He allows that feedback loops can have a causal impact on brain states, but defends the orthodox view that brain states alone constitute the minimal supervenience base for perception. Block explains the orthodox view:

Importantly, the minimal supervenience base for an experience that occurs at time t is an instantiation of a physical property at t . . . only the features of the brain *now* are needed to determine the phenomenal character of experience *now*" (2005: 264).

This sketch of the orthodox view looks to be a straightforward reformulation of temporal atomism. Hurley, following Dennett, argued that temporal atomism is an unwarranted presupposition. And as I tried to show above, EVPS follows from the rejection of temporal atomism. So Block is correct that temporal atomism is important to this debate, but he misses the point by criticizing EVPS after assuming the truth of temporal atomism.

In fairness, Block was discussing Noë's version of EVPS, which is not explicit about rejecting temporal atomism. As I indicated in the beginning of this article, though, it is crucial that EVPS is understood within its philosophical tradition, a tradition that includes (at least) Dennett and Hurley, as well as Noë. Block also appeals to the distinction between causation and constitution in formulating his objection to EVPS. I will return to this distinction in the third section of the article.

The second objection to EVPS comes from another article about Noë's book, this one by Jesse Prinz (2006). Prinz suggests that EVPS would find support if it could be shown that "when we keep the brain fixed and change the environment, there can be changes in experience" (2006: 16). Again, the unease about EVPS surfaces as a commitment to temporal atomism, a commitment to the idea that an instantaneous snapshot of neural activity fixes experiential character. It is relevant to mention here that the notion of keeping the brain fixed is a philosopher's fiction. Even if the suggestion is charitably understood as keeping all of the relevant endo- and exosensory input fixed, there is always ongoing spontaneous changes in neural activity. The living brain always has its own intrinsic dynamics (Arieli et al. 1996), which is one reason why temporal atomism is unmotivated.

Prinz goes on to criticize EVPS on the basis of Wilder Penfield's classic experiments involving brain stimulation. He takes issue with Noë's account of the experiments. Noë claims that brain stimulation can only induce simple sensations, and Prinz points out that patients reported vivid experiences and rich biographical memories as a result of the stimulation. As far as the truth of EVPS is concerned, though, I do not think that it really matters who is correct on this issue about degrees of richness.² What does matter is the basic way in which one understands the effects of what Penfield was doing.

There are at least two ways of describing Penfield's experiments. The first is the way a temporal atomist would describe it, and the second is the way an advocate of EVPS should describe it. First, the temporal atomist could say that Penfield's stimulation directly brought about a brain state that determines a particular phenomenal character. Say the sensation induced was the smell of burnt toast. Under this first kind of description, the stimulation activated the burnt toast representation in cortex directly. That is, there is a state of cortex that fixes the phenomenal character as of the smell of

² For a detailed discussion of Penfield's work from a philosophical perspective, see Bickle and Ellis (2005).

burnt toast, and the stimulation brings about this state.

The friend of EVPS, and foe of temporal atomism, should describe Penfield's results differently. The denial of temporal atomism is motivated by the view that the subpersonal vehicles of phenomenal content are intrinsically dynamic (Hurley 1998: 30-31). To put it differently, the trajectory through neural state space matters; the location in neural state space at any instant does not. Penfield's intervention does not merely activate a neural representation. Instead, it changes the trajectory within the neural state space. Since -- as a matter of empirical fact -- there was ongoing cortical activity prior to the electrical stimulation, the stimulation should be understood as a perturbation, rather than an activation of something dormant. On this second description of Penfield's stimulation, the phenomenal experience of the smell of burnt toast is due to a perturbation in the ongoing dynamics of cortex. It is important to keep in mind that there was ongoing activity within Penfield's patient's brains. It is also important to keep in mind that the patients were having experiences both before and after Penfield issued the stimulation. It is not accurate to say that the stimulation "created" or "generated" experience, because the stimulation only changed the nature of the subject's experience.³ If one thinks of brain activity as an ongoing process, then the accurate description of the Penfield stimulation is that the ongoing process was disrupted. But disrupting an important part of a larger process does not justify the conclusion that the events occurring at that part of the process are sufficient for determining properties of the whole process.

A first reason to prefer this second description of Penfield's intervention is that there is an increasing trend in neuroscience to understand cortical activity in terms of the ongoing dynamics of cortex (Raichle 2010, for pioneering work in this area, see Freeman

3 Subjectively it may seem as if an experience is suddenly activated, or generated out of nothing. But this 'seeming' does not reflect what we know about neural activity. My discussion here is meant to focus on neural dynamics rather than first-person descriptions of particular experiences. I thank an anonymous referee for pointing out this ambiguity in the text.

1999). The second reason to prefer this second description can be found in Dennett's original motivation for questioning temporal atomism: masking.⁴ Say the stimulus which normally induces a sensation of burnt toast was applied to cortex at t_0 . Then at t_1 , there is some second causal impact on cortex -- either transduced or direct. Is it plausible that this later causal impact could mask the sensation of burnt toast? I think so. And if so, then the wider causal network, impacted at t_1 , along with its massive feedback connections and ongoing dynamics is also playing a crucial role in the experience as of burnt toast. If we want to have a full account of the experience, then we ought to include these other contingent neural factors in our description of the way in which the original intervention *can* induce the sensation of burnt toast.

Why would this alternative description of Penfield's work help EVPS in any way? After all, this description does not entail that the smell of burnt toast involves external vehicles. But EVPS is not committed to vehicles *always* being partly external. Importantly, this second description explains the results of Penfield's work in a way that is compatible with forms of explanation that do involve external vehicles. Recall how I suggest we understand Hurley's claim that temporal extension leads to spatial extension. In order to explain the way in which Penfield's probe induces a conscious experience, it may be best to consider the relevant causal impact of the probe over time. This causal impact could include the way in which it modifies the ongoing dynamics in distant parts of cortex. As the causal impact spreads over time, it also spreads in space, and would likely include both short and long range feedback loops. Now, the relevant feedback loops may not extend into the body and world, but it is not unlikely that they extend beyond the local stimulation (Logothetis et al. 2010). Nor is it unlikely that ongoing neural and metabolic activity is required to enable the subject to have the sensation of burnt toast. Importantly, if we adopt this approach in our explanations of perceptual states involving transduction, rather than direct stimulation, the feedback loops do often extend further

⁴ This point does not require a commitment to the details of Dennett's subsequent analysis of visual masking (Todd 2006).

into the body and world (Hurley 1998, chapter 8). Rejecting temporal atomism leads to spatial extension.

The final objection comes from Fred Adams and Ken Aizawa, who have been devoted opponents to a number of versions of the extended mind hypothesis, including EVPS. A great deal of their criticism has been directed at the purported confusion between causation and constitution, to which I will return below. First, though, I would like to discuss an analogy that they use in order to illustrate the causal/constitutive confusion. Adams & Aizawa have repeatedly appealed to the model of an air-conditioning system as way of objecting to vehicle externalism. This analogy is especially useful in revealing how Adams & Aizawa are also in the grips of the Cartesian Theater.

Their purpose for introducing the analogy of an air-conditioning system is to illustrate a mistake purportedly made by various proponents of the extended mind hypothesis. According to Adams & Aizawa, these thinkers fail to distinguish between a system, on one hand, and a process within that system, on the other hand. They explain:

Take an air conditioning system. Such a system typically includes a thermostat with electrical connections to the house's breaker box, a refrigerant, an expansion valve, an evaporator coil, a compressor, a condenser, a fan, and insulated pipes for carrying the refrigerant in a closed loop between the evaporator and the compressor . . .

All of these components are linked by well-defined, relatively simple, reliable interfaces. Nevertheless, in an air conditioning system, not every component of the system "conditions" the air. Not every component cools the air. The evaporation coil cools the air, but the thermostat, the ductwork, the fans, and the compressor do not.

(2008: 117, also 2001: 56).

The process of conditioning the air occurs at a particular location within the larger

system. It would be a mistake, Adams & Aizawa suggest, to think that the entire system cools the air. All of the other parts of the system play a causally important role in the cooling of the air, but none of those other parts actually do the cooling.

As a challenge to EVPS, the air conditioning analogy can be applied to perception in a straightforward manner. Retinal transduction, saccades, head and body movements, and proprioceptive feedback loops are all parts of the physical system that causally enable perceptual experience. But the place in which perception actually happens is somewhere in the skull.

The appeal of this analogy betrays the lingering influence of the Cartesian Theater: just as there is a place where the air is cooled, so there is a place where visual experience happens. If we follow Dennett and Hurley in rejecting the idea that there is a particular place where experience happens, then we ought also to reject the analogy of the air conditioning system. Here one may object that a proponent of EVPS is actually committed to experience happening at a particular place, just a place bigger than the cortex.⁵ As a response to this objection, I note that EVPS makes a claim about the vehicles of perceptual states, but it does not say that experiences happen at the location of those vehicles. The reason why experiences do not happen at a particular place, for Dennett and Hurley, is because the causal processes which enable those experiences are temporally extended. As I understand it, the thought is as follows. If experiences are enabled by dynamic sub-personal processes, then there is no precise time in which an experience occurs. And if there is no precise time, then there is no precise place either. In contrast, there seems to be a precise time and place in which the air is cooled in the air conditioning analogy.

Adams & Aizawa use this analogy as a way of bringing out a main charge against

⁵ I thank Ken Aizawa for raising this point.

proponents of EVPS as well as proponents of the extended mind in general. The charge is that proponents of extension fail to appreciate the distinction between causation and constitution. Extra neural processes have a causal impact on cognition and perception, but, according to the orthodoxy, they do not constitute cognition or perception. Since all three of the objections that I discuss here include an appeal to this distinction, I now turn to this distinction as it relates to the Cartesian Theater and temporal atomism.

III. Dynamics, causation, and constitution

The main point of this article has been to show how three important objections to EVPS all fail to appreciate the rejection of the Cartesian Theater and temporal atomism. The original formulations of all three of these objections include the charge that proponents of EVPS fail to distinguish between things which play a causal role in perception, on one hand, and things which constitute perception, on the other. In this third section of the article I will try to make some sense of the way in which this distinction ought to be understood by a proponent of EVPS. In particular, I try to uncover a tension between the distinction itself and the rejection of temporal atomism. I suggest that resolving this issue will involve dealing with some larger issues concerning explanation in cognitive neuroscience.

Block, Prinz, and Adams & Aizawa all accuse EVPS proponents of confusing causation with constitution.⁶ They all happily grant that sensorimotor feedback loops have a causal impact on experience, but it is only the stuff within the skull, they maintain, which constitutes perceptual experience.

On one hand, it is tempting for EVPS proponents to question, or even reject, the distinction between causation and constitution (Hurley 2010: 106). Using examples from

⁶ See Adams & Aizawa (2008: chapter 6) for a full discussion of the scope of this purported fallacy.

economics and physics, Ross & Ladyman have made the case that the distinction has no place in the mature sciences (2010).

On the other hand, rejecting the distinction makes the significance of EVPS questionable, as Adams & Aizawa point out (2008: 100). If EVPS is to be non-trivial, then it must do more than make a claim that is already widely accepted; it must do more than claim that non-neural processes play a causal role in experience. And in order to make such a stronger claim, one must presumably distinguish between mere causation and something more than mere causation.

Before looking at some of the relevant details, I would like to make the following rhetorical point. It can be conceded that supporters of EVPS have more work to do in addressing the distinction between causation and constitution. But this concession does nothing to help the case of the EVPS opponent. The opponents of EVPS have offered very little in the way of illuminating the distinction. As Hurley has pointed out, insisting that neural processes are constitutive and that extra-neural processes are causal is simply begging the question (2010: 106). The examples offered by Adams & Aizawa and by Block are not very illuminating either. The former make use of their air-conditioner analogy in order to illustrate the distinction.⁷ The place in which the air is actually cooled constitutes the cooling process, and all the other processes in the system merely play a causal role in the system. This analogy fails for reasons explained above. Block has also offered an example:

What does "constitutive" mean? Among other things, *constituent*:
Hydrogen is partially constitutive of water since water is composed
of hydrogen and oxygen. (2007: 482)

This example is not helpful because it frames the discussion in a way foreign to scientific practice. Contemporary chemistry forms explanations in terms of the causal properties of

⁷ Adams & Aizawa also appeal to the notion of underived content. A discussion of this suggestion would take the article off course. For critical discussion, see Hurley (2010: 106 - 107) and Rowlands (2010).

molecules *and their dynamics*. There is no issue of constitution over and above these causal properties. Ross and Ladyman make this point:

. . . water is composed by oxygen and hydrogen in various polymeric forms, such as $(\text{H}_2\text{O})_2$, $(\text{H}_2\text{O})_3$, and so on, that are constantly forming, dissipating, and reforming over short time periods in such a way as to give rise to the familiar properties of the macroscopic kind water. The usual philosophical identity claim "water is H_2O " ignores a rich and subtle scientific account that is still not complete. (2010: 160).

It may be clear enough to analyze our intuitions about the constitution of everyday familiar entities, such as the constitution of an orchestra (Simons 1987: 146). But it is a mistake to understand hydrogen as partially constitutive of water in the way in which David Finckel is partially constitutive of the Emerson String Quartet. In terms used by Sellars, our intuitions about the manifest image should not be forced upon the scientific image.

For the rest of this section, I will try to sketch the way in which a proponent of EVPS could address the distinction between causation and constitution. EVPS makes a claim about the "vehicles of human perceptual states." In order to make for an interesting claim, these "vehicles" must be more than entities which have some causal impact on perception. But it is problematic to claim that these "vehicles" constitute perception, since we have no clear criteria for what should count as constitution in psychological explanation. And it appears that we will not find clear criteria by looking at more mature sciences, either (Ross & Ladyman 2010).

It seems clear to me that more work needs to be done; my goal here is to sketch the way in which this work might proceed. I take the following comment from Hurley as my point of departure:

I see no basis independent of explanatory success for regarding factors

within some prespecified boundary as deeply or constitutively explanatory, while those outside it are explanatory only in some shallower or “merely causal” way. I take issues about internalism and externalism to be issues about explanation. (2010: 113-114)

In this passage, Hurley moves towards a position in which she can make a claim stronger than "mere causation" while at the same time keeping a distance from the causal/constitutive distinction as deployed by her adversaries (and allies). The key is that we ought to be guided by explanation. This suggestion looks reasonable, but I am not sure that it addresses the core disagreement between internalists and externalists. After all, internalists are interested in explanation as well. Internalists just happen to think that the best explanations draws boundaries around the system that are roughly coincident with the human skull.

The real disagreement, as I have tried to illustrate in the sections above, is the disagreement about dynamics. The distinction between constitution and causation can be fruitfully deployed in some kinds of mechanistic explanation (Craver 2007: chapter 4). But in dynamical modeling of systems, the distinction can be awkward and unwelcome. I suspect that the larger issue at play in this debate may reflect a tension between mechanistic and dynamical explanations (Chemero & Silberstein 2008). Here is not the place to explore the degree to which there is a real disagreement between these types of explanation in cognitive neuroscience, but I will quickly mention some examples to show why the distinction between causation and constitution is ill-suited for dynamical explanations.

Dynamical systems are mathematical models which can predict the way in which observable properties will change over time. They do not require rigid spatial boundaries, nor do they fit with everyday intuitions about causation and constitution. This point can

be illustrated with a simple example from Steven Strogatz.⁸ Strogatz has discussed models of large populations of fireflies who synchronize their phases and blink in harmony (2003). The degree to which one oscillator influences another oscillator is given by the coupling constant, K , in the following model of two coupled oscillators (from Strogatz 1994: 274):

$$d\Theta/dt_1 = w_1 + K_1 \sin(\Theta_2 - \Theta_1)$$

$$d\Theta/dt_2 = w_2 + K_2 \sin(\Theta_1 - \Theta_2)$$

Θ represents the phase of the oscillators, the rate of change of their phases is $d\Theta/dt$, and the natural frequencies of the oscillators is w . When the coupling constants are relatively high, it becomes difficult to apply our intuitive notion of causality, since we are no longer able to isolate the causal role played by each oscillator in the system. In a sense, both oscillators are causing the behavior of both oscillators. The important point here is that coupled systems in the natural world tend to give us an epistemic barrier. In studying complex nonlinear systems, such as these coupled oscillators, we are unable to assign precise causal roles to discrete parts of the systems, nor are we able to make use of intuitions about constitution. In addition, we are often unable to isolate a part of the system as being a sufficient condition for bringing about some state of the system as a whole (Strogatz 1994: 8 - 9).

Strogatz offers a nice way of thinking about these coupled oscillators (1994: 274).

Imagine two friends, Harold and Eric, running around a circular track. They each have their own preferred natural pace, but they want to run together, as partners. If their own paces are similar enough, and if the coupling constants (which reflect their desire to run together) are high enough, they will synchronize and run together at a particular pace. Say they are able to synchronize. Now, how would we explain Eric's pace? I suppose a common sense answer would be that his pace is determined by the way in which his brain moves his muscles, or that Eric constitutes his own pace. The problem with the common

⁸ Hurley also makes a similar point using examples from developmental psychology and cognitive neuroscience (2010: 131-132).

sense answer is that the way in which Eric's brain moves his muscles is continuously sensitive to the pace of Harold, just as Harold's brain is sensitive to the pace of Eric. The best explanation of Eric's pace requires a model of the system which includes Harold. If, as Hurley suggests, we "track the causal arrow through time," we end up following a loop between the two runners (1998: 307). *This ongoing causal loop contains no boundary within which the constitution of pace occurs.* The causal/constitutive distinction does not apply here.

Adams & Aizawa discuss a similar model, one in which two pendulums are coupled. They point out that the fact that the pendulums are coupled does not make it true that the motion of the first pendulum extends into the motion of the second. I suppose that they are correct on this point, though it is not entirely clear what it would mean for a motion of one thing to extend into another thing. Besides, the issue here is one of constitution. Regarding constitution, they claim

Obviously, the correct understanding of this case is that, while the motions of the first pendulum are causally influenced by the second pendulum and the spring, the motions are not constituted by the second pendulum and the spring. (2008: 111)

It is not clear how this point is meant to have relevance for the debate. What principle are they using to distinguish between the cause of the motion and the constitution of the motion? If it is the principle of a perceptually salient boundary of a body, then they are begging the question. Is it a conceptual claim that the motion of x is constituted by x and nothing besides? If so, then making such a conceptual claim about cognition or perception would also beg the question.

Dynamical explanations include causal feedback loops for which perceptually salient boundaries are irrelevant. Since the distinction between causation and constitution appears to depend on such boundaries, dynamical explanations do not fit well with this

distinction. As mentioned, though, this conclusion leaves some explaining for the supporter of EVPS. Perhaps the best path may be to unpack the meaning of "vehicles of human perceptual states" in a way that makes an interesting claim about perception without requiring the distinction between constitution and causation. The fan of EVPS could explain talk about "vehicles" by claiming that our best dynamical models of human perceptual states are models which include properties outside of the skull. This claim may not be as radical as some have taken EVPS to be, but being radical is not a necessary condition for progress.

Note that this more moderate understanding of EVPS -- as a claim about our best models, rather than a claim about constitution -- is not compatible with views on both sides of the extended mind debate. Both externalists and internalists think that there is a fact of the matter regarding the constitution of various mental states (Adams & Aizawa 2008: 89). To accept this more moderate reading of EVPS is not to place one's allegiance with one side or the other of the extended mind debate. Instead, by moving away from claims about constitution, one moves beyond the debate altogether. Again, the moderate reading of EVPS as a claim about our best models is not radical. But this reading is not trivial either: there is still wide room for disagreement, such as the disagreement found in the debate over representational or mechanistic models, on one hand, versus dynamical systems models, on the other.

Conclusion

In this article I have considered EVPS, which is a kind of externalism found in the work of Hurley (1998, 2010) and Noë (2004). A main theme of the article is that critics of EVPS have failed to appreciate Hurley's original motivation for the thesis, a motivation that is inspired by Dennett. The key insight behind EVPS is that the physical processes that enable perceptual experience are extended in time. If we follow the causal impact of

those trajectories over time, we find a system that extends beyond the boundary of skin and skull. In the second part of the article I argued that three main objections to EVPS rely on the presuppositions that Dennett and Hurley had rejected, presuppositions such as the Cartesian Theater and temporal atomism. In the final part of the article I showed how the causal/constitutive distinction does not apply to explanations involving complex dynamics. In contrast to widespread presuppositions, the causal processes underlying perception may be dynamic. If temporal atomism is false, then there is no showtime at the Cartesian Theater.

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