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Sensorimotor knowledge and the radical alternative

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Abstract. Sensorimotor theory claims that what you do and what you know how to do constitutes your visual experience. Central to the theory is the claim that such experience depends on a special kind of knowledge or understanding. I assess this commitment to knowledge in the light of three objections to the theory: the empirical implausibility objection, the learning/post-learning objection and the causal-constitutive objection. I argue that although the theory can respond to the first two objections, its commitment to know-how ultimately renders it vulnerable to the third and arguably most serious objection. I then suggest that sensorimotor theory has two options: concede the causal-constitutive objection or challenge it. I shall argue for the latter. I will claim that a radical sensorimotor theory offers the best means of responding to this objection.

Keywords: O'Regan and Noe, sensorimotor theory, sensorimotor knowledge, know-how, practical understanding, radical enactivism.

1 Introduction

O'Regan and Noe (2001) have argued that what you do and what you know how to do constitutes your visual experience. Sensorimotor theory challenges internalist notions by claiming that it is embodied know-how or skillful engagement with the environment that realizes such experience. This theory has undergone many changes since its inception in 2001 (for example, see Noe and O'Regan, 2002; Noe, 2004, 2009; O'Regan, 2011) yet throughout these changes, proponents of the theory have remained committed to the claim that visual experience is realized by embodied know-how or skillful engagement. Indeed, Noe (2004) states that "[t]his is one of the central claims of the enactive or sensorimotor approach to perception" (p64)

The theory has had some high profile critics. Prinz, Aizawa, Clark and Block have all argued that it faces a number of important objections. In this paper, I will focus on three of these objections: the empirical implausibility objection, the learning/post-learning objection and the causal-constitutive objection. I will argue that although the theory (both in its original 2001 formulation and later incarnations) can respond to the first two objections, its commitment to know-how ultimately renders the theory vulnerable to the third and arguably most serious objection.

I think this leaves the theory with two options. It could concede the point to the causal-constitutive objection. Sensorimotor theory then becomes a methodological and/or epistemic claim about visual experience. Or the theory could challenge the objection. I shall

argue that sensorimotor theorists should endorse option two. I will suggest that they do this by "going radical". Utilising arguments offered by those who have both criticized and developed sensorimotor theory (for example, Hutto, 2005, and Hutto and Myin, 2013), this paper will describe how a radical version of sensorimotor theory can successfully challenge the causal-constitutive objection.

The layout of this paper is as follows. In section 2, I offer a brief outline of sensorimotor theory. In section 3, I examine three objections that challenge sensorimotor theory and argue that the causal-constitutive objection poses the most serious challenge. In section 4, I sketch out a radical sensorimotor theory.

2 Sensorimotor theory

O'Regan and Noe (2001) argue that "vision is a mode of exploration of the world that is mediated by knowledge of what we call sensorimotor contingencies" (p940). Sensorimotor contingencies are understood to be relations of lawful dependence between features of an agent's sensory apparatuses and features of the agent's environment. These contingencies are sensory since they refer to the agent's sensory apparatuses (for example, eyes, ears, hands, noses etc) and they are motor since they refer to how those apparatuses react to the environment during movement by the agent.

For example, a sensorimotor contingency unique to human vision is the following:

"If you are looking at the midpoint of a horizontal line, the line will trace out a great arc on the inside of your eyeball. If you now switch your fixation point upwards, the curvature of the line will change; represented on a flattened-out retina, the line would now be curved. In

general, straight lines on the retina distort dramatically as the eyes move, somewhat like an image in a distorting mirror" (O'Regan and Noe, 2001, p941).

O'Regan and Noe argue that this demonstrates the lawful dependence between movement of a human sensory apparatus (the eyeball) and a feature of the environment (a horizontal line). They also argue that each human sensory modality - vision, touch, taste, sound and smell - corresponds to a unique set of sensorimotor contingencies (ibid).

The key claim O'Regan and Noe make in their 2001 paper is that it is an agent's practical knowledge of sensorimotor contingencies - the agent's sensorimotor know-how - that constitutes the agent's visual experience.

For example,

"the feeling of seeing a stationary object consists in the knowledge that if you were to move your eye slightly leftwards, the object would shift one way on your retina, but if you were to move your eye rightwards, the object would shift the other way. The knowledge of all such potential movements and their results constitute the perception of stationarity" (O'Regan and Noe, 2001, p949).

It is worth noting that there is nothing inherently controversial in the claim that what an agent does influences what the agent perceives. It is a commonplace to assert that actions help shape and guide perception. Where O'Regan and Noe's sensorimotor theory earns its spurs however is in the constitutive role it assigns to embodied know-how or practical understanding. For sensorimotor theory, knowledge or mastery of sensorimotor contingencies is more than just causally important to visual experience. Rather know-how or

skillful engagement with an environment is what constitutes or realizes that experience.

Significantly, Shapiro (2011) identifies two possible interpretations of this claim. On the first weaker interpretation, it is only necessary that an agent have the potential to exercise sensorimotor contingencies. According to this interpretation, "it is important only that one has, sometime in the past, acted on the world in ways that created knowledge of sensorimotor contingencies" (Shapiro, 2011, p168). As Shapiro notes, this interpretation is available when, for example, O'Regan and Noe claim that perception of stationarity is dependent on "the knowledge of all such *potential* movements". On the second stronger interpretation, the agent has to "actually practice those actions that reveal sensorimotor contingencies" (ibid). This interpretation is available when, for example, O'Regan and Noe claim that it is movement or action that reveals the sensorimotor dependence between the eyeball and the horizontal line. These two interpretations of what I will call the knowledge claim will play important and decisive roles in the following section.[1]

3 Objections and replies

3.1 The empirical implausibility objection

A prominent objection to sensorimotor theory is that it is empirically implausible to think that actions or bodily movements are needed in order to have sensory experience. Prinz (2006) offers examples that suggest this claim is empirically implausible when applied to visual experience and Aizawa (2007) offers an example that suggests it is implausible when

[1] One of the ways in which sensorimotor theory has been developed since its inception in 2001 is by applying the theory to sensory modalities other than visual experience. For example, Cooke and Myin (2011) offer a discussion of how a broadly sensorimotor approach is applicable to smell. Applying sensorimotor theory to modalities other than visual perception raises its own set of issues. Nonetheless, I would argue that any applications of the theory that retain a commitment to embodied know-how or skillful engagement will have to address the issues outlined in section 3.

applied to tactile and/or auditory experience.

Prinz states that

"[p]erception is not impaired by spinal cord injuries that cause paralysis, by paralysis of eye muscles or brain structures that control them, by atrophy of motor cortex in Lou Gehrig's disease, by destruction of action-control centers in parietal cortex, or in frontal cortex (which are presumably destroyed in many cases of Broca's aphasia)… [I]t is certainly noteworthy that no motor deficits seem to undermine the ability to perceive. There are clear dissociations between perception and action. People with motor deficits can see the world, and people with perceptual deficits can act in it" (Prinz, 2006, p10).

Prinz's claim is that people suffering from paralysis of the body still retain the ability to perceive the world around them. In which case, it is empirically implausible to argue, as he suggests sensorimotor theorists do, that visual experience is always dependent on bodily movement. As he puts it, there are important dissociations between perception and action.

Aizawa (2007) recounts an example of someone who experienced awareness of touch and sound during surgery despite the administration of anesthesia and neuromuscular blockades. He describes a 74-year old woman who "recalled that during her operation "1) she felt pain during the incision of the abdomen, 2) she heard the operator say, "It is difficult to remove all tumors because the adhesion is very strong" and 3) she remembered someone had been walking around her"" (Aizawa, 2007, p23). This would seem to demonstrate the empirical implausibility of the claim that an agent must move or act in order to have tactile and/or auditory experience of the world around them.

The empirical implausibility objection has had some high profile advocates and although the original 2001 version of sensorimotor theory primarily focused on visual experience, it is relatively straightforward to see how the Aizawa example could be used to block the application of the theory to other forms of sensory experience. Yet I am going to suggest that O'Regan and Noe's original claim has the means to respond to this objection.

As we have seen, O'Regan and Noe claim that visual experience is constituted by know-how of sensorimotor contingencies. Following Shapiro, we identified two possible interpretations of this claim. On the weak interpretation, visual experience only requires the potential to exercise these sensorimotor contingencies. That is, as long as an agent has exercised the relevant contingencies at some point in the past, then they can obtain the relevant experience. However, on the strong interpretation, the agent must realize the relevant contingencies now through actions or bodily movements in order to have the experience.

I would argue that it is the strong interpretation that the Prinz and Aizawa examples target. For if paralysed individuals can still have experience (visual in the Prinz example, tactile and auditory in the Aizawa example), then this suggests that any strong interpretation of the O'Regan and Noe claim is indeed empirically implausible. An agent need not always act or move in order to have sensory experience.

However, if O'Regan and Noe were to reject the strong interpretation and instead adopt the weak interpretation, then they would have the means to respond to the objection. For if it is the potential role played by embodied know-how that constitutes sensory experience, then this practical understanding can remain even if an individual is currently unable to move. On this interpretation, it an agent's *acquired practical knowledge* or *understanding* of

how bodily movement and sensory stimulation depend upon each other that constitutes their experience and not simply their current bodily movement. Hence, a paralysed individual can retain visual experience (and/or tactile and auditory experience) since they possess this acquired know-how. A weak interpretation of the knowledge claim then is not vulnerable to the empirical implausibility objection since such an interpretation does not entail that the agent must currently act or move in order to have sensory experience.

3.2 The learning/post-learning objection

One of the ways in which O'Regan and Noe's sensorimotor theory has been developed is by using it to explain sensory substitution devices. For example, it has been used to explain how agents can gain experience of the world around them via Bach-y-Rita's Tactile Vision Substitution System or TVSS (1972). [2]

TVSS consists of a head or eyeglass mounted camera whose visual output is transduced to trigger an array of vibrators which are placed somewhere on the body of a blind (or blindfolded) subject. After training with the device, during which time the subject moves with the device and learns how movement alters the sensory tactile input, subjects begin to report experiencing objects arrayed in three-dimensional space around them. It is also reported that they are able to make judgments about the number, relative size and position of objects in their environment (Noe, 2004, p26).

Noe (2004) has argued that a TVSS device enables the user to replicate (albeit in a limited way) the sensorimotor interaction that a normal-sighted person would have with their environment. He claims

[2] For more recent versions of such devices, see O'Regan, 2011.

"[t]actile vision is vision-like because (or to the extent that) there is, as it were, an isomorphism at the sensorimotor level between tactile vision and normal vision. In tactile vision, movements with respect to the environment produce changes in stimulation that are similar in pattern to those encountered during normal vision. The same reservoir of sensorimotor skill is drawn on in both instances" (2004, p27).

In other words, the TVSS user is able to gain vision-like experience because they acquire the embodied know-how of the sensorimotor contingencies that, in a sighted person, normally governs visual interaction with an environment.

However, Clark (2009) challenges this explanation of TVSS. He argues that TVSS is not evidence that the vision-like experience of the TVSS user is realized by sensorimotor contingencies. Clark argues that it is problematic to take "evidence for the role of whole sensorimotor loops in *training and tuning* the neural systems that support conscious perception for evidence of the ongoing role of such loops" (p970, emphasis in original). This is because "nothing in the evidence makes this the case. Perhaps embodied activity is just a causal precondition of setting or re-setting parameters in neural structures that once set and activated, suffice for the experience in question?" (ibid). In other words, there may be an important learning/post-learning distinction (what Clark calls "training and tuning") and it is only during learning to use the TVSS device that sensorimotor contingencies play a crucial or pivotal role.

In response to Clark, I will argue that, as with the empirical implausibility objection, the sensorimotor theorist can reply to a learning/post-learning objection (though such a reply may not save the theorist, as we will soon see).

Given Clark's learning/post-learning distinction, it would seem to follow that in any post-learning phase only internal factors can constitute the vision-like experience of the TVSS user. As we have seen, TVSS is a touch-based apparatus (since it consists of an array of vibrators placed somewhere on the body) and consequently principally activates (among other things) the somatosensory cortex in the brain of the user (Noe, 2004, p27). The only internal factor that can be appealed to then in a post-learning phase is the somatosensory cortex. The sensorimotor theorist can thus argue that the internalist needs to explain how and why such cortex can realize vision-like experience. That is, how and why does such cortex support vision-like experience as well as tactile experience?

Hurley and Noe (2003, p145) argue that cortex can acquire visual properties when it is embedded within the particular sensorimotor dynamics characteristic of that modality. If so, then the somatosensory cortex of the TVSS-user can be part of the physical processes that realize vision-like experience because such cortex now defers to the skillful patterns of sensorimotor contingency characteristic of visual experience. The advantage of this explanation for the sensorimotor theorist is two-fold. First, it clarifies how cortex that is associated with touch can, when embedded within the right extended sensorimotor dynamics, also become associated with vision and so explains the experience of the TVSS user. Second, it suggests that even if there is a learning/post-learning phase in the TVSS user's experience, internal factors alone cannot explain this since the internal factor i.e. the activation of somtosensory cortex, remains relatively constant.

Clark however is not swayed by these considerations (see 2009, pp971-972). Moreover, Clark could argue that the weak interpretation of the knowledge claim is in fact compatible with the learning/post-learning distinction. For the weak interpretation only requires that

sensorimotor contingencies have been exercised at some point. If the exercise of sensorimotor contingencies were to occur during the learning phase (after which sensorimotor knowledge assumes a potential role), then this is compatible with Clark's claim that during a post-learning phase internal (neural/Central Nervous System) processes assume the pivotal role in TVSS. Clark would need to show how somatosensory cortex can realize visual experience. But if, as he argues, the sensorimotor explanation is only an explanation about the *content* of the TVSS user's experience, then such an explanation does nothing to exclude "standard internalist views about the local (neural) *vehicles* of content" (2009, p971, emphasis added).[3] Thus, a weak interpretation might actually support rather than challenge Clark's learning/post-learning distinction. This point will be developed further in section 3.3. For now it will suffice to note that issues of know-how could potentially be problematic for sensorimotor theory.

3.3 The causal-constitutive objection

Block (2005) claims that "even if perceptual experience depends causally or counterfactually on movement or another form of activity, it does not follow that perceptual experience constitutively involves movement" (p6). He argues that how experience is produced merely reveals the causal basis of perceptual experience and does not reveal what constitutes that experience. This is because "[t]o suppose that the issue is one of how experience can be produced is to shift the topic from a constitutive issue to a causal issue. Certainly the causal sources of our experience include sensorimotor causal loops, but that does not settle the constitutive question" (ibid).

Recall that for O'Regan and Noe, "vision is a mode of exploration of the world that is

[3] Though see the hard problem of content (section 4) for a possible reply to this move by Clark.

mediated by knowledge of what we call sensorimotor contingencies" (2001, p940). The causal-constitutive objection is the claim that how visual experience is produced is a separate issue from what experience is. In other words, determining the causal basis of visual experience does not determine what constitutes that experience. Thus, even if embodied know-how may cause perception, this fails to show that such know-how is part of the metaphysically necessary conditions needed for perception to occur.

In section 2, I introduced Shapiro's distinction between the weak interpretation and the strong interpretation of what I called the knowledge claim. As section 3.1 showed, the strong interpretation is empirically implausible. This leaves the weak interpretation. Yet the weak interpretation looks vulnerable to the causal-constitutive objection.

Consider the following example. O'Regan and Noe claim "the feeling of seeing a stationary object consists in the knowledge that if you were to move your eye slightly leftwards, the object would shift one way on your retina, but if you were to move your eye rightwards, the object would shift the other way" (2001, p949). Yet Block could reply that acquiring the feeling of seeing a stationary object may initially involve engaging sensorimotor know-how i.e. learning how the perception changes with certain bodily movements. But on the weak interpretation, once this visual experience is acquired, then sensorimotor know-how assumes a potential role and a potential role is just that - all it means in reality is that you just see the stationary object. There is in fact no longer any need for embodied know-how.

This opens the door to the causal-constitutive objection. For if sensorimotor know-how is only required during the acquisition of visual experience, then it can only show how such experience is produced and not what constitutes that experience. Moreover, as we saw in section 3.2, the weak interpretation is compatible with the claim that internal

(neural/Central Nervous System) processes could be the metaphysically necessary conditions that realize or constitute visual experience. Simply put, sensorimotor know-how may cause perception but it is still the brain and processes within it that constitute it.

The causal-constitutive objection thus amounts to a two-pronged attack on the knowledge claim: (1) sensorimotor know-how only reveals how visual experience is produced and not what constitutes or realizes that experience and (2) an orthodox, internalist view of visual experience is actually compatible with claims about sensorimotor know-how. Since the knowledge claim is central to sensorimotor theory, then this is arguably the most serious objection faced by the theory.

What then are the options for sensorimotor theory? I think there are two possibilities. One is to simply concede the point to the causal-constitutive objection. Since the objection targets the constitutive claims made by sensorimotor theory, then the theory could just drop those commitments. Sensorimotor theory then becomes a methodological claim about how we should investigate visual experience and/or an epistemic claim about how we come to have knowledge about (rather than for) such experience. These claims may still be significant even if they would entail a downgrading of the ontological reach of the theory.

However, a further option is to challenge the causal-constitutive objection. It is this option that I shall argue for. Hutto (2005) and Hutto and Myin (2013) have both criticized and subsequently refined the original claims made by O'Regan and Noe. In the following section, I shall show how Hutto's development of sensorimotor theory and Hutto and Myin's radical enactivism potentially gives sensorimotor theory the necessary firepower to challenge this objection.

4 Going radical

If sensorimotor theory is to challenge the causal-constitutive objection, then it will need to (1) undermine the picture of visual experience that the objection assumes and (2) show why rival internalist accounts of visual experience – the sort of accounts that would support the causal-constitutive objection - are themselves problematic.

Hutto (2005) argues that sensorimotor theory should abandon the idea that know-how is needed for visual experience. He claims, "the basic *character* of perceptual experience is determined by the features of the different sensory modalities and how they respond to specific objects" (2005, p395, emphasis in original). But he denies that this requires any form of knowledge:

"it is not knowledge – not embodied know-how per se – that gives perceptual experiences their character but *facts about the nature of our embodiment in relation to particular active engagements*. These are facts that we do not know and do not need to know in order to have experiences" (2005, p401, emphasis added).

For example,

"I know that if I take an object from a well lit room to a poorly lit one it will look different. In which ways, I cannot say exactly – even when the object is familiar to me. This does not mean that the way I experience is not dependent upon the appropriate sensorimotor contingencies, only that it is not knowledge of them, at any level, that matters to my perceiving" (2005, p398).

On Hutto's account of sensorimotor theory, visual experience is constituted by sensorimotor contingencies but it is not dependent on knowledge or know-how of those contingencies. I think this abandonment of know-how helps undermine the picture of visual experience that the causal-constitutive objection assumes. For on the Hutto view, how experience is produced is determined by facts about our embodiment in relation to particular active engagements. This view entails that these facts and the determining role they play constitute visual experience. In other words, the "how" and the "what" of visual experience have the same explanans, namely facts about our embodiment. [4] As such, how visual experience is produced is not separable from (and so does tell us something about) what constitutes visual experience. This is a very different picture of experience from that assumed by the causal-constitutive objection.

However, this is only the first stage in a possible challenge to the causal-constitutive objection. The second stage is to show why rival internalist views about visual experience are problematic.

Internalism requires that the brain play a privileged role in perception. There are a number of considerations that could support this view. One is that future empirical work will reveal that there are special mechanisms within the brain that ensures that the brain plays this special role. If there are any such mechanisms, then the brain is indeed privileged over any potential bodily interaction with an environment. This possibility, were it confirmed, would challenge any externalism about visual experience, though as Hurley and Noe (2003) have shown, claims about brain mechanisms are compatible with sensorimotor explanations. Nonetheless, since it is arguable that evidence of such a possibility is (at present) not

[4] Rowlands (2010, p78) argues that enacted mind (what I call sensorimotor theory) is in fact a claim about embodiment. I think Hutto's version of sensorimotor theory would agree with this. On the Hutto view, the theory is a claim about the embodied nature of visual experience.

available, I will set-aside this consideration for the moment.

Another consideration available to the internalist is to argue that the brain is privileged over bodily interaction because it processes information about the external world, that is, it "trades in" or "traffics in" informational content about the world. Claims about content are at the heart of the orthodox input-output view of visual processing. Briefly, the story is that information arrives in the brain via the sensory organs and it is then processed according to certain rules or algorithms. This results in some representational state with informational content about the world. This state then leads to further processing and/or signals being sent to the peripheries and possible bodily movement. Such a picture obviously privileges the role of the brain (since this is where the real action happens) and consequently provides support for an internalist view about perception.

However, Hutto and Myin (2013) argue that such an internalist story must to face up to what they call the Hard Problem of Content. This is the problem that "positing informational content is incompatible with explanatory naturalism. The root trouble is that Covariance doesn't Constitute Content" (2013, pxv).

Information-as-covariance is the information revealed when there is a reliable covariance between states of affairs. For example, the rings of a tree reliably co-vary with the age of the tree such that the rings can be used to obtain information about the age of the tree. However, "[a]nything that deserves to be called content has special properties - e.g. truth, reference, implication - that make it logically distinct from and irreducible to mere covariance relations holding between states of affairs. Though covariance is surely scientifically respectable, it isn't able to do the required work of explaining content" (Hutto and Myin, 2013, p67). This entails that states of affairs "do not 'say' or 'mean' anything just

in virtue of instantiating covariance relations" (ibid). In other words, information-as-covariance does not constitute information-as-content.

This leads Hutto and Myin to make the following claim:

"[i]f covariance is the only scientifically respectable notion of information that can do the work required by explanatory naturalists, it follows that informational content doesn't exist in nature – or at least it doesn't exist independently from and prior to the existence of certain social practices. If informational content doesn't exist in nature, then cognitive systems don't literally traffic in informational content…[T]here is no naturally occurring informational content in the world" (Hutto and Myin, 2013, pxv).

If Hutto and Myin are right, then the sort of internalist story of visual experience sketched earlier must confront the hard problem. For if the brain is privileged during perception because it "trades in" or "traffics in" informational content about the external world via representational states, then it needs to be shown how this claim can be given a naturalistic explanation. That is, it needs to be shown how the sorts of informational covariances that can be confirmed between brain states and events in the external world can substantiate claims about informational content.

The internalist has a number of options here. One is to argue, "contentful properties exist even if they don't reduce to, or cannot be wholly explained in terms of, covariance relations" (Hutto and Myin, 2013, p68). Such properties might be explained by, for example, "some future physics". Another option is to claim that such properties might be "explanatory primitives – metaphysical extras that might be externally related to covariance properties"

(ibid). This "might require us to expand our understanding of the scope of the natural" (Hutto and Myin, 2013, pp68-69).

A further move is to simply deny that covariance doesn't constitute content and show that contentful properties do reduce to covariance properties (Hutto and Myin, 2013, p69). Yet, as Hutto and Myin note, "the metaphysical costs [of this move] will be too heavy for most" (ibid). Alternatively, the internalist could aim to "show that the required notion of information is meatier than covariance but is nonetheless equally naturalistically respectable" (ibid). However, the obvious candidate here – Dretske's indication relations (1988) - seems to go beyond information-as-covariance (Hutto and Myin, 2013, p70).

I will not adjudicate on these various options. I list them merely to show what is involved in confronting the hard problem and the sorts of questions an internalist must answer if they wish to claim, for example, that the brain plays a privileged role because it utilizes representational states with informational content.

I think these various considerations demonstrate how "going radical" can offer sensorimotor theory a way to challenge the causal-constitutive objection. First, the theory abandons the knowledge claim, that is, abandons the claim that embodied know-how is needed for visual experience. [5] This succeeds in undermining the picture of experience assumed by the objection. Second, the theory argues that any internalist view of perception that is committed to informational content must confront the hard problem. A radical

[5] If a radical sensorimotor theory abandons the knowledge claim, then how does it explain the visual experience of, say, someone who is paralysed? On the Hutto reading, an agent's visual experience is constituted by facts about the agent's embodiment. Someone who is paralysed remains an embodied agent. The extent to which their embodiment differs from an able bodied person will be the extent to which their visual experience differs from an able bodied person. But, conversely, the extent to which their embodiment remains the same will also be the extent to which their visual experience remains the same.

sensorimotor theory avoids the hard problem by denying that there are naturally occurring informational contents in the brain for basic perceptual states and arguing instead that although the brain is necessary for such states, it is not privileged over body-world interaction. Thus, contrary to the causal-constitutive objection, a radical sensorimotor theory can retain its ontological commitments since it can affirm the constitutive role assigned to sensorimotor contingencies.

5 Conclusion

I have examined three objections to sensorimotor theory: the empirical implausibility objection, the learning/post-learning objection and the causal-constitutive objection. I have argued that although the theory can respond to the first two objections, it remains vulnerable to third and most serious objection. I then suggested that this leaves the theory with two options: concede the causal-constitutive objection or challenge it. I argued that sensorimotor theory should endorse the second option. I claimed that it could do this by "going radical". This involves abandoning the knowledge claim and rejecting informational content as needed for basic perceptual states. Setting aside concerns to do with special mechanisms, I conclude that a radical sensorimotor theory can potentially challenge this objection.

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