Radical Embodied Cognition, Affordances, and the (Hard) Problem of Consciousness

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Abstract

Tony Chemero advances the radical thesis that cognition and consciousness is actually the same thing. He draws this conclusion from his understanding of cognition as an extended process. I question this conclusion because this view expands cognition beyond being the sort of natural kind to which one can tie phenomenal experience. Moreover, because cognition has been radically inflated, despite Chemero's claim to the contrary, embodied cognition does not solve any of the hard problems associated with consciousness.

Keywords: radical embodied cognition; consciousness; perception-in-action; the hard problem.

Novel stimuli capture our attention. This well-known fact forms the basis for several contemporary theories of theories of mind and brain, including Tony Chemero's notion of embodied cognition (Chemero 2009). Chemero holds that noticing unexpected events is key to understanding the larger cognitive system of which our brains are one part. He also believes that expecting some event to occur in the world is somehow tied to our conscious experiences.

In his book *Radical Embodied Cognition* (2009; see also Silberstein and Chemero 2012, 2015) Chemero (along with Michael Silberstein) advance the radical thesis that cognition and consciousness is actually the same thing. He draws this conclusion from his understanding of cognition as a dynamical, non-linear, relational, and extended process. I question this conclusion. Even if, we are the brain-body-environment synergies that Chemero and others claim we are (e.g., Anderson et al. 2012, Silberstein and Chemero 2012, Kello and van Orden 2009, Kelso 2009), we will not be able to conclude that consciousness and cognition are two sides of the same coin because this view expands cognition beyond being the sort of natural kind to which one can tie phenomenal experience. Moreover, contra Chemero's claim that "the problem of qualia does not arise in radical embodied cognitive science" (2009, Loc 2530/3178), embodied cognition does not solve any of the hard problems associated with consciousness. Nonetheless, some of Chemero's views do help us understand some aspects of conscious experience.

Radical Embodied Cognitive Science

Most date the recent embodied movement in cognitive science to the work of Rodney Brooks (1991a, 1991b) and Francisco Valera, Evan Thompson, and Eleanor Rosch's book *The Embodied Mind* (1991), though of course J.J. Gibson's ecological theory is its earliest contemporary incarnation (Gibson 1962,1966,1979). This work was intended to be an antidote for computational views of mind, in which perception, memory, and thought all become manipulations of brain-based mental representations.

Proponents of embodied cognition hold agents' bodies, and often their local environments, are not only physically relevant to cognition, but are also causally constitutive. Moreover, cognition is not the rational and abstract process that computationalists assume, but instead is dedicated to helping our bodies move and act upon our environment.

We evolved as a species to take advantage of our environment, and we do so as we solve so-called cognitive problems. In many cases, what at first appears to be a difficult problem to solve using abstract representations and computations divorced from the physical world turns out to be much easier to resolve if we are allowed to consider our bodies and our environment as cognitive resources. It is easy for a human to learn to move about on land because Mother Nature designed our legs for walking on Earthly terrain (Thelen and Smith 1994). In other words, instead of using our brain to solve problems, we manipulate our bodies and our environments to dissolve them. Moreover, in doing this, we can also alter our bodies and our environments such that the problems we need to solve also change. Gathering food presents a different sort of challenge in a cultivated field, compared to an unspoiled savannah rich with bison.

Hence, instead of thinking of the agent and its environment as two separate entities that occasionally touch each other, it is better to see them a single, interacting, system. It follows from this perspective that cognition is extended into the environment. It also follows that any mathematical model of this larger system should describe how it unfolds dynamically over time, which would require non-linear differential equations.

What makes Chemero's views of embodied cognition radical is that he claims that dynamical systems theory, which we need to be able to model cognition, does not presuppose mental representations, or indeed any representations at all. If brains, bodies, and environment form one unified system, then there is no need for one part of the system to represent another part of the system for everything is always and already connected. Perception, action, and thought itself are all non-representational and non-computational. Let us accept this view as true and see how he might explain consciousness using this understanding of human cognition and action.

Conscious Cognitive Systems

Silberstein and Chemero (2012) hold that conscious experience is "an essential feature of extended brain–body– environment systems" (p. 36) and that phenomenology and cognition are "inseparable and complementary aspects of coupled brain-body-environment systems….Experience is cognition and cognition is experiential" (pp.40-41). They each "co-determine" the other (p. 41). They get there by positing that some version of neutral monism must be true, if the thesis of radical embodied cognition is true (Silberstein and Chemero 2015). They trace this metaphysics back to William James, who held that there was no actual difference between the so-called objective world out there and the subjective experience of the world in each of us. "What represents and what is represented is here numerically the same" (James 1904, p. 484). Both the subjective and the objective are defined in opposition to one another, and both are ways of understanding the world, which is the "more basic neutral 'stuff' of experience" (Silberstein and Chemero, 2015, p. 186). Hence, one cannot have cognition, an objective process, without also having at the same time, consciousness, the subjective experience.

Computational theories of mind artificially create a problem for consciousness, for they give the impression that one can have mental computation without concomitant conscious thought. We get the problem of consciousness because we can imagine non-human, apparently unconscious, machines instantiating a computational theory of mind. That is, we can imagine cognition without consciousness, or so we think.

This is the hard problem of consciousness, a challenge that dates back to at least Gottfried Leibniz in 1714:[1] because we can imagine a something that is identical to a human's (or a brain's) physical interactions without also imagining that thing's consciousness, it appears that nothing about any physical interaction should give rise to phenomenal experience. And yet, we are conscious, nonetheless. How can this be? (Leiniz's answer, like David Chalmer's (1995, 1996) more contemporary one, is to posit that consciousness is a fundamental part of the ontology of the universe.)

But if computational theories of mind are false, then this particular problem of consciousness does not arise. Cognition is a feature of our extended and embodied system, as is consciousness. By "[refusing] to separate meaningful cognition and phenomenology" (2012, p. 41), Silberstein and Chemero believe that they have eliminated the so-called hard problem of consciousness essentially by definitional fiat. They assert that, "neutral monism properly conceived really does deflate the hard problem once and for all" (2015, p. 182).

Can they do this? To answer this question, we need a more complete picture of what they are envisioning an extended phenomenological-cognitive system to be.

Our nervous system has its own spontaneous and internally generated dynamics, which in turn create transient neural assemblies comprising our sensorimotor capabilities. We are coupled to our environment via these sensorimotor structures, which result in changes to both our internal transient neural assemblies via sensory feedback and in the external environment via behavioral responses. Over time, we become attuned to nuances in the extended brain-body-environment system that complements our sensorimotor sensitivities and external features; this is our niche.

What we perceive in our environment via our sensorimotor structures (and probably other related neural assemblies) are nothing less than Gibsonian affordances, relational features of the brain-body-environment system used to guide our actions and behavior. They are what the environment contains and what we can do. Silberstein and Chemero claim that the "set of affordances" we perceive in our world, "*just is* the environment as [we] experience it" (2012, p. 43, italics theirs). Hence, "cognition and conscious experience can be understood as a single phenomenon"

[1] "Moreover, it must be confessed that perception and that which depends upon it are inexplicable on mechanical grounds, that is to say, by means of figures and motions. And supposing there were a machine, so constructed as to think, feel, and have perception, it might be conceived as increased in size, while keeping the same proportions, so that one might go into it as into a mill. That being so, (we should, on examining its interior, find only parts which work one upon another, and never anything by which to explain a perception. Thus it is in a simple substance, and not in a compound or in a machine, that perception must be sought for. Further, nothing but this (namely, perceptions and their changes) can be found in a simple substance. It is also in this alone that all the internal activities of simple substances can consist" (Leibniz 1714, section 17).

(p. 35). Consciousness "is inseparable from cognition, which is the ongoing activity of a nervous system, body, and niche non-linearly coupled to one another" (p. 43).

Just as our neural assemblies are not anatomically hardwired – they are "softly" assembled – so too are the borders of the brain-body-environment system. How far and how much we extend into the environment depend a great deal on what we are trying to do and what barriers or assistance the environment provides to us. The entire system itself then is also a soft assembly whose interaction dynamics determine its structure.

Some call such interaction dominant, softly assembled, systems "synergies." A synergy is a set of structural units that temporarily link together to form a single cohesive functional system. It is maintained or changed on the fly as its dynamics and processes ebb and flow over time (Anderson et al. 2012, Kelso 2009).

We know that we have a synergy when we can measure pink noise associated with it. Pink noise, or 1/*f* noise, refers to a signal in which the power spectrum density (energy per Hz) is inversely proportional to the frequency. (It is called pink noise because visible light with this power spectrum looks pink.) We can contrast pink noise with white noise, which has equal energy on every frequency. Pink noise is also a hallmark of fractal timing and appears to be ubiquitous in nature, occurring in everything from cosmic background radiation to flooding patterns of the Nile River (see also Strogatz 2004 for a popular way into these phenomena). It is an indication of nested, self-similar structures that occur over time. Guy van Orden and his colleagues (2003) argue that pink noise signifies just the sort of interaction-dominant, softly assembled, system we have been discussing as a model for cognition. (See also Miyazaki et al. 2004.) And with this technical idea in hand, scientists are now able to manipulate and measure our dynamic embodiment experimentally.

For example, Chemero and his colleagues devised an experiment that forces change in our extended cognitive synergy (Dotov et al., 2010, 2017). Undergraduates engaged in a simple video game, using a computer monitor and a mouse. At irregular intervals during each trial, the connection between the mouse and the monitor was disrupted. Interestingly, pink noise is present at the hand- mouse interface until the disruption. Once the disruption is over and the connection returns to normal, the pink noise returns. These measures index changes in the boundary of the extended cognitive synergy. During the normal phase of the task, the mouse is part of the system. During disruption, it is not.

Most important for our purposes, the measures of pink noise correlate with our conscious experiences. When we are engaged in the video game, we are not aware of the hand-mouse interface per se, but once the connection between mouse and monitor is altered, then the mouse grabs our attention and we become aware of it. The point is, we project ourselves into our environment, and in so doing, we experience the edges of our extended system. We have long known that this is the case, but it is only now that psychologists have been able to develop metrics for measuring changes in our projections.

The pink noise of our cognitive synergy indexes our phenomenal experience. I think that this is the best argument for why the picture Chemero paints might in fact be true. We notice and pay attention to, experience, things that do not match our predictions or expectations. And we experience these things in terms of what we could do, or how we could act. Our experiences are about or of the relationship we have with the world, which is continuously changing and evolving.

These mixes of brain, body, and environment are what Gibson called objective-subjective hybrids. And that fact, Chemero believes, solves the problem of consciousness. For this is how subjectivity exists in an objective world–it exists in the on-going relationship between an agent and the context of its actions. (The relationship itself is neither subjective nor objective. This is the neutral substrate that allows us to define subjectivity and objectivity as two different aspects of the same "monism.")

The Hard Problem is Hard

What is wrong with this story? Essentially, it is that the sort of non-linear coupling that links us with our environment is found at all sorts of levels of organization. Without further analysis, we cannot identify which level corresponds to cognition; hence, tying consciousness to cognition either means consciousness exists at multiple levels of organization, which strikes most people as improbable, or more work needs to be done to delineate consciousness cognition from other synergies. If we need to do more work, then the problem of consciousness remains to be solved.

To take one example, we find synergies within the brain itself. These are softly assembled, interaction-dominant, nonlinear dynamical systems whose behavior strongly resembles prototypical cognition, perception, and action. It is questionable whether these systems are also conscious.

Neuroscientists are now capable of recording responses from thousands of neurons simultaneously. It is becoming clear that neural correlates for things like memory and decision-making are at the population level (Abbott 2012). Modeling studies show that while the action potentials of individual neurons might appear disordered and uncoordinated, population level activity is not.

We know that neurons and neural circuits have to respond quickly and flexibly as contexts change. This means that they need to be able to ignore irrelevant information while reacting to whatever is important to the larger task at hand. Neural responses in the frontal eye fields in monkeys were recorded as they performed a visual discrimination task using noisy stimuli. It turns out that individual neurons simultaneously respond to the motion and color of stimuli, the context, as well as the target itself. However, these signals are separable at the population level through linear regression (Mante et al. 2012). Importantly, stimuli analysis at the population level is integrated with motor choices, just as proponents of embodied cognition would have predicted. We see similar dynamics in the olfactory system of the fly (Luo et al. 2010).

One important facet of nonlinear dynamical systems is that they are nested systems, and their components exhibit the same sort of dynamics as the system as a whole. Individual neurons and the ion channels in neurons also appear to have the same dynamical pink noise properties as the activity of populations of neurons (White et al. 1998, Yu et al. 2005). While most are comfortable believing that monkeys are conscious, it is less clear that we want to assert that flies are, and it is even more problematic to assert that parts of monkey brains or fly brains are conscious.

Chemero perhaps could wriggle out of this problem with his definition of cognition. That is, these might be synergistic systems, but they are not cognitive synergies. He defines cognition as "the ongoing, active maintenance of a robust animal-environment system, achieved by closely coordinated perception and action" (2009, loc. 2696/3178). In other words, the sorts of dynamically coupled systems I have been discussing are necessary but not sufficient for cognition. He is restricting consciousness to the brain-body-environment system's level, or perhaps even to the animal brain-body-environment system. If you move inside the head, while there might exist dynamical systems modeled in identical ways to an animal brain-body-world synergy, there would be no actual cognition. And no cognition would mean no consciousness either, according to Chemero's view.

Of course, this move does not solve the hard problem of consciousness, since it does not explain what might be special about the animal brain-body-environment synergy such that it has consciousness but the olfactory system of the fly brain does not. Indeed, this move echoes the challenge before the computationalist: what is it that is special about human (or primate or animal or whatever is conscious) computations that make them conscious? *Prima facie*, there is nothing about the computations themselves that should give rise to conscious experience, and there are certainly many computational systems that we believe are not conscious. Similarly, we can ask: what is it that is special about an animal brain-body-environment interaction that is cognitive and therefore consciousness? *Prima facie*, there is nothing about being an animal synergy that should give rise to conscious experience. In particular, there does not seem to anything special about an animal brain-body-environment interaction that an animal brain piece-body piece-environment interaction would not also share. Put another way: there does not seem any reason to believe that the neutral monads that comprise our world exist at the level of animal-environment relations as opposed to animal-part-environment relations.

Of course, another alternative is that Chemero could bite the bullet here and conclude that fly pieces are indeed conscious, in their own sort of fly-ish way. Being an interaction-dominant, softly assembled, pink noise sort of synergy is both necessary and sufficient for cognition and therefore for consciousness as well. The right sort of dynamics is all you need for cognition; the nested components of the nonlinear systems have all the same properties as the mother system, and this would include cogitating and consciousness.

Perhaps, though, he would not want to do this, since, as Silberstein and he point out, one advantage of tying consciousness to cognition is to "[eliminate] fruitless philosophical discussion of qualia and the so-called hard problem of consciousness" (2012, p. 35). They want to get rid of the challenge of envisioning odd machines as being conscious because they are computing over representations by denying that conscious systems compute at all. But here we are, back discussing an odd machine and whether it has experiences. This time, however, we are wondering whether the system is cognitive after all.

The complaint similar to the one Chemero and Silberstein lodge against traditional consciousness studies can also be lodged against them. While we can define cognition as a particular type of synergy, and we can believe that cognition just is an extended, softly assembled animal brain-body-environment synergy, and we can deny that manipulating representations has anything to do with humans thinking, we still do not escape the fundamental problem with explaining consciousness, that is, explaining why anything at all is conscious.

In other words, there is no reason why a neutral substrate should be conscious. It is, according to their view. But just as we can imagine (or so the story goes) things that are functionally identical to humans but are not conscious, so too can we envision complex brain-body-environment synergies comprised of a neutral substrate that is not conscious. The hard problem remains.

Or, perhaps a more accurate way to describe Silberstein and Chemero's move: consciousness just is an inherent aspect of affordances. Like Chalmers, they try to eliminate the hard problem by making consciousness part of the fundamental structure of the world. But just as with dualism, one needs an argument or evidence for why subjectivity appears where it allegedly does.

Coda: Consciousness, Projection, and Action

However, there is at least one important difference between the brain-body-environment synergies and the human coupling described above that might give us some insight into conditions for conscious awareness: we do not or cannot project ourselves psychologically onto or through the other individuals. Unlike driving a car, in which we can "feel" the tires on the road, when coupled with another person, we do not "feel" the other person's feet hitting the ground. Whatever sort of system or synergy coupled humans are, the psychological reality of having an animate object in the environment is quite different from having an inanimate object. Inanimate object-environment synergies are transparent to us; human couplings are not.

There has to be something fundamentally different between the two. What is it? I argue that the difference lies in how we perceive the respective affordances. And insofar as how we perceive affordances is tied to how we consciously experience the world, then it could be that Chemero is onto something after all.

For example, there are some odd cases of associative agnosia in which patients are unable to recognize or name living things (like lions or opossums), but they can recognize and name inanimate objects (like forks and radios) without a problem (Satori and Job 1988). If we take a traditional neuro-reductionist point of view, then we should conclude that information about living things is stored in a different place in the brain than information about inanimate objects. Damage to the "living thing" place in the brain results in patients with deficits in recognizing living things and damage to the "inanimate object" place results in patients with deficits in recognizing inanimate objects. But interestingly, and perhaps counter-intuitively, there are very few cases in which a patient cannot recognize inanimate objects, but can recognize living things. We don't get the neat double dissociation that neuropsychologists love.

If there are two separate areas for living and inanimate objects, then why would we find brain damage possible in one area but not the other? Antonio Damasio (1990) suggests that this pattern could be due to a difference in how we perceive living and inanimate objects. In particular, we manipulate inanimate objects, but, for the most part, we do not living ones. As a result, we would be activating a greater number of brain regions when we perceive inanimate objects than when we do living things: in both cases, we activate the areas associated with visual perception, but in the case of seeing a tool in our environment, we also activate kinesthetic and motor movement brain regions. (Imaging studies bear out Damasio's conjecture, cf., Gerlach et al. 2002, Kellenback et al. 2003.) Hence, it might be the case that we do not have different brain areas that respond differentially to living versus non-living objects, but rather that we just have more regions involved with one type of perception over another. With more regions activated in response to inanimate objects, and therefore more regions that would have to be damaged in order to see the related agnosia, it would not be surprising that we have a hard time finding patients with deficits naming inanimate objects but not living ones.

Here then is the hypothesis: we distinguish objects in our environment based on how we (potentially) interact with them. We perceive living things by their visual features and concomitant affective responses, but inanimate objects based on functional properties. This, of course, is just another way to look at affordances: we see and understand the objects around us in terms how we relate to them, and they to us. But now we can go further: not only are differences in psychological projection between animate and inanimate objects tied to perceptual differences, but also to action-decisions and consciousness itself.

I am claiming that we do not project ourselves through what we perceive to be other living things in our environment. We can only project ourselves through objects that we manipulate functionally (I note that there might be good exceptions to this general rule; for example, when we use a living thing as a tool in our environment. A practiced person might project through a trained seeing-eye dog to the environment beyond.) And, we can only extend our conscious experience into whatever psychological space of projection we have available to us. One limit on our conscious experience is not just the edge of the affordance, so to speak, but it is also the type of affordance we perceive. Functional objects become psychologically transparent to us, such that we project our conscious experiences through them. Animate objects do not.

I conclude: Chemero (and Silberstein) cannot escape the hard problem of consciousness by positing neutral monism. Nevertheless, there is something right about his position. Consciousness is connected to or indexed by or co-occurs with or identical to our perception of affordances, which is intimately tied to how we interact with the objects in our environment. We are aware of what we intend to manipulate in our environment in order to achieve our behavioral goals. Hence, consciousness is not identical to all cognition; it is not even identical to all brain-based cognition.

Instead, it is deeply linked to one very important part of our cognitive processes: perceiving affordances just prior to action.

Acknowledgments

Early versions of the paper were presented to the Society for Philosophy and Psychology, the University of Waterloo, and at the Conscious Persons workshop at Calvin College. Many thanks to all the participants for their helpful and thoughtful comments. Special thanks are also due to Tony Chemero and Mike Silberstein for engaging with me on this topic, and to the referees for the Cognitive Science Society, whose thoughtful comments made this essay better. This research was partially supported by the Templeton Foundation and the University of Cambridge.

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