

How Embodied Is Cognition?

Daniel D. Hutto is Professor of Philosophical Psychology at the University of Wollongong, and co-author of *Radicalizing Enactivism* (MIT Press, 2013).

Patrick McGivern is Senior Lecturer at the University of Wollongong specialising in the philosophy of science, philosophy of mind, and metaphysics.

E is the letter, if not the word, in today's sciences of mind. E adjectives proliferate. Nowadays it is hard to avoid claims that cognition – perceiving, imagining, decision-making, planning – is best understood in E terms of some sort. The list of E-terms is long: embodied, enactive, extended, embedded, ecological, engaged, emotional, expressive, emergent and so on.

What's the big idea? In stronger and weaker ways, E-approaches propose that cognition depends deeply on the dynamic ways in which cognizers use their bodies to engage with wider world. Different E-proposals, each in their own way, attempt to rethink the classic 'sandwich' view of cognition. The sandwich view regards cognition as a pure stage of processing that occurs tidily in-between perceptual inputs and behavioural outputs – cognition is imagined to be the meat in the sandwich, surrounded by the bread of bodily inputs and bodily outputs of the non-mental external world. So conceived, cognition is typically imagined to be something that occurs wholly within the brain (or some part of it). World-involving embodied engagements have a part to play in this story of cognition, to be sure: inputs are assumed to be bodily-based and outputs take the form of bodily actions. Yet, on the traditional view, while cognition is informed by bodily engagements and informs the shape of such engagements, strictly speaking cognition and non-neural bodily interactions never mix. At most, embodied engagements play supportive roles in enabling cognition and they are enabled by cognition.

Embodied cognition has great potential for improving practice in many domains: law, aesthetics, art, literature, music, architecture, mental and physical health and sports science. Children, for example, can clearly benefit from the finding that they learn better if they gesture while they talk. This comes as no surprise if in gesturing they are really thinking with their hands. But we need to discover *how* it is that people think with their hands and their bodies – if they do – and not just *that* they do. Only with greater understanding will we be able to harness what we may yet learn about cognition and how embodied it is for its greatest practical benefit.

A great body of experimental work encourages the idea that cognition may depend more strongly and pervasively on embodied activity than was previously supposed. Consider the classic problem faced by baseball outfielders. They need to position themselves in order to catch fly balls. How do they manage it? Rather than engaging in advanced independent reasoning about the ball, its speed, its trajectory in order to make predictions that then instruct and drive their behavior it seems that solving the outfielder's problem is largely, and possibly wholly, a matter of initiating the right sort of embodied activity in the right circumstances. Outfielders simply run so as to keep the ball's trajectory looking straight. Doing that is enough to guarantee that they get where they need to go.

Other results put pressure on the idea that perceivers take in all of the available visual information from the environment and process it all at once. Work on change and attention blindness reveals that under certain conditions a significant proportion of perceivers typically fail to notice even quite dramatic changes occurring in their unconcluded visual fields. Such changes include some major

item being removed from a scene (a boat, a church); some major item being introduced (a person in gorilla suit walks by, one's conversant is swapped); a background colour changing; the size of something in clear sight changing; and so on. Massive changes of this kind tend to be missed when there is a momentarily masking of the scene attending to or when perceivers are given tasks that occupy their attention.

There is much philosophical debate about the import of these findings. What might we make of them? There are a number of options. Focusing on the last set of findings, most conservatively, perceivers might be immediately and automatically taking in all the relevant information from the environment all at once, after all, even if they are failing, for some reason, to make ready and full use of it. Slightly more radically, it might be that perceivers are taking in and processing much less information – perhaps as little as possible – and instead using the environment and their selective engagements with it to reduce the cognitive load to a considerable extent. Much more radically, it might be that perceivers are not taking in and storing any information at all, but instead continually and actively engaging with selective aspects of their environment in sensitive ways.

The competing theoretical possibilities just described reveal that the kinds of evidence associated with E-approaches – of which the above cases represent but the slightest fraction – does not, by itself, defeat the traditional view of cognition that regards it as distinct from non-neural world-involving bodily activity. Nevertheless, this type of experimental data has inspired new and more radical E-ways of thinking about the nature and basis of cognition. It has encouraged some to question whether perceiving, and cognition, is best understood as neatly carved off from temporally extended embodied activity. It is now a serious hypothesis that cognition may not be wholly brainbound and wider embodied engagements may replace or reduce the need to posit calculations over mental representations when explaining how we complete many, if not all, cognitive tasks. The possibility that thinking may occur in action and not only in the head or the brain is under serious discussion and investigation.

The E-movement, which first established itself in the early 1990s, has begun to mature and has now surely come of age. Even so there is no single agreed upon framework. The various E-approaches are best understood as family. The members of the family all have some things in common. They are related in terms of their common origins – usually in resisting traditional ways of thinking about mind and cognition more or less staunchly. But, as with many families, there are also some divisions and certainly not all members of the family subscribe to anything like a single unifying set of central tenets. For the most part, although different members of the E-family might be able to sit at the table together and to agree on the importance of certain issues it is not as if all members of the family see eye to eye on every issue. There are some disagreements, even quite fierce disagreements, on matters of importance amongst members of the E-family. This is, of course, where the nice philosophical work needs to be done.

Members of the more conservative wing of the E-family see no need for any major revisions in our thinking about cognition. They believe that facts about the embodied character of cognition can be reconciled with the classical conception of cognition – a conception that characterizes the essence of cognition in terms of information processing and computations over representations. Nevertheless, E-theorists of this stripe tend to accept that our understanding of representational mind needs an important upgrade in order for this to work. Rather than understanding mental representations in classically sentential terms – with syntax and semantics ideally designed for bearing propositional contents – new wave thinking moves away from the symbol-crunching paradigm and construes mental representations as active or action-oriented. Action-oriented representations are geared to drive specific sorts of actions. Action-oriented representation still count as representations because

their role is to indicate the presence of and to contentfully represent various objects and states of affairs, but they do this work by making use of special sorts of vehicles or formats.

The most moderate theorists in the conservative wing of the E-family attempt to accommodate recent findings about embodied character of cognition while still conceiving of cognition as wholly representational and entirely brainbound. They do this by positing representations that represent features of the body and by assuming that these bodily representations have special formats. Ultra-conservative views of embodied cognition assume that cognition is fundamentally a matter of manipulating representations in the brain, even if the neural representations in question have special contents and features and play a much larger and more basic role in cognition than was previously supposed.

In line with this, it is hypothesised that there may be bodily-formatted representations that serve to represent states of the body, and which do so in distinctive neural formats that enables them to interface directly with certain bits of neural machinery. It seems that when it comes doing some kinds of cognitive work only a representation with bodily vehicle will do. Allegedly, this could explain the pervasive phenomenon of neural re-use. Neural re-use is certainly consistent with there being bodily formatted representations that carry bodily contents in special codes that cannot be re-formatted or used by any system other than a specific neural one. However, this proposed explanation also raises some important and difficult questions. Why draw the vehicle/content distinction at all in such cases if it is accepted that the contents of bodily-formatted representations can never be separated from their special bodily formats so as to be used by other cognitive systems? After all, the need to draw the vehicle/content distinction was originally inspired by our capacity to samesay in natural language – namely, the capacity to express the same content or message using different linguistic vehicles, codes and syntax. For example, I can say the very same thing – express the same proposition – in English or French: ‘It is raining’ and “Il pleut”, for example, express the same content using different linguistic vehicles. Yet this capacity for samesaying is precisely what bodily-formatted representations apparently lack. The causal efficacy of such representations appears to reside wholly in their special structural properties, making it unclear exactly what explanatory work might be done by the contents they are imagined to have or how such contents might do such work.

There is a milder, yet still conservative possibility too – one that fits more easily with the findings that emphasize the importance that non-neural, temporally extended embodied engagements make to cognition. It is the idea that action-oriented representations – those specially geared to produce certain types of action – might extend across the non-neural body and environment. Proponents of these more mildly conservative views retain the idea that cognition makes use of content-involving forms of representations while endorsing a view of the vehicles of content that places great stress on the central contributions to cognition made by embedded, embodied engagements. Recently there have been attempts to combine these proposals with those that posit sparse inner models in the brain. The internal models are allegedly to do critical predictive coding work – work on multiple scales and levels that enables embodied activities to be adjusted appropriately before they are completed, based on error-reducing feedback. Thus according to the milder variety of conservative embodied view special kinds of minimal, action-oriented, representations play a critical part in such internal modeling activity, but they do so by being ultimately informed by and in order to drive and steer dynamic and extended cognitive processes. As such these milder hybrid accounts offer the best of both worlds, holding out the promise of that we might have our traditional cognitive cake and eat it too.

A main virtue of conservative E-theories, whether ultra or mild, is that they can appeal to a familiar ‘mark of the cognitive’ when it comes to saying what puts the ‘cognitive’ into embodied cognition. At the same time, they can appeal to the special nature of the contents (for example, which may be about the body as opposed to the world) as well as special character of the vehicles or formats that carry such contents in order to say what puts the ‘embodied’ into embodied cognition.

The E-family also has some more volatile members, those who promote radically, revolutionary, replacement views of embodied cognition. Proponents of this vision of embodied cognition give pride of place to spatially and temporally extended interactions, abandoning the idea that the primary and defining work of minds is always and everywhere that of representing and computing. Replacement approaches fully oppose the traditional view that cognition essentially involves the collection and transformation of information in order to fuel cognitive processes that enable the representation of the world. In line with this they look to the processes common to all living things rather than computational operations as the best model for the nature of cognition. Accordingly various forms of cognition are characterized as essentially taking the form of organismic activity involving informationally sensitive interactions stretching across the brain, body and environment. Originally inspired by scientific developments in robotics, dynamical systems theory and ecological psychology, the basic idea that cognition just is a kind of embodied activity also finds philosophical support from the phenomenological, American naturalist and Buddhist traditions of thought.

There is considerable diversity even within the more radical wing of the E-family. Some radicals draw more on ecological psychology – invoking its understanding of perception as being ‘for action’, according to which what perceivers really perceive are possibilities for action that are salient in their environments.

Other radicals are inspired by the idea that every organism – not just humans but even those of the simplest kinds, such as bacteria – engages in a kind of basic sense-making, and that in developing ways of engaging with their environments successfully they in effect ‘enact’ or ‘bring forth’ their worlds. Through embodied engagement a world ‘shows up’ for individuals. Organismic activity – engaging with environments features in ways that are life sustaining – suffices for the most basic kinds of cognition. Crucially, in emphasizing dynamic engagement such activity does not depend upon or require the individuals in question to extract informational content from the world and to process and manipulate such content in order to attribute properties to the world.

The root idea at work in all of these radical E-approaches is that at the basis of cognition what we find is organisms engaged in concrete, spatio-temporally extended patterns of dynamic interaction with their environments. The ‘embodied’ in embodied cognition, according to these proposals, is not to be understood in terms of an intuitive, everyday understanding of bodies and their boundaries. Rather the notion of embodied in play understands cognition in terms of wide reaching, world-involving organismic interactions that are contextually embedded. These interactions are assumed to take the form of activity that unfolds over time and which essentially involves individuals engaging with aspects of their environments.

Radical E-theorists hold that these dynamic interactions – in which they assume cognition literally consists – are loopy not linear. For example, in ordinary cases, perceptual experience is made possible by environmental engagements that involve a continuous series of responses to select aspects of the environment on the part of organisms – responses that call into play many areas of the brain and non-neural body. Multiple areas and processes in the brain and body, operating at various scales, are involved in the mutual and concurrent interactions, engendering patterns of simultaneous reciprocal causation between the environment, the brain and body. Importantly, from this vantage, cognition is best understood as already extensive. It neither leaks out from the mind, nor in from the

world. There is no way to isolate any properly cognition constituting ‘inner’ activity from properly non-cognitive ‘outer’ activity that allegedly stands over and against the former as mere causal contributions stemming from the non-neural body or environment. On this vision of cognition, there is simply no prospect of making any such principled division.

To advance and enrich our understanding of the nature of cognition, the big questions that future research must address are: just *how embodied is cognition* and just *how is cognition embodied*. Answering such questions requires adjudicating between the various conservative and radical E-options. That, in turn, can only be satisfactorily achieved by answering the Retention Question. We need to clarify what role, if any, representations play in our best cognitive science explanations. The burning question is: Do representations play an explanatory role in embodied cognition? In line with the ultra conservative, mildly conservative and more radical E-approaches three possible answers suggest themselves: Complete role, Limited role, or No role.

There are different sorts of challenges on the way forward for those taking different E-cognition path. On the one hand, those conservatives who are convinced that representations do play some kind of role in cognition need to clarify how much of a role they play and exactly what kind of a role they play. The work multiplies if representations come in various kinds, since then taxonomy is required. Crucially, they also need to clarify what kinds of properties representations must have in order to play their designated roles. Knowing such things would be the crucial first steps in gaining an enriched understanding of the nature of E-cognition.

Those attracted to the more radical options, on the other hand, must address the infamous scope problem – the worry that the sorts of explanations of behavior that can be provided without bringing mental representations into the story are extremely limited and won’t scale up. Hence, that such explanations cannot cope with the more exciting so-called representation hungry forms of cognitive phenomena – those involving form of off-line or strongly decoupled cognition about things that are absent or abstract. Here it is important to recognize that there are more or less extreme versions of radical E-approaches. The more moderate versions of radical E-cognition allow that some forms of cognition may involve content or representation, even though the basis of cognition is always rooted in interactions that do not involve content. Thus even when cognition is content involving it is always grounded in the dynamic ways that contentful representations are manipulated and used.

Given these challenges it is important to note that radical E-approaches are often motivated by a deeper philosophical concern. There are serious grounds for thinking that we may never get a convincing explanation of how content-bearing mental representations fit into the natural order – not even at the end of science. On standard realistic assumptions, if this turns out to be true – barring mysterianism – this gives us reason to be skeptical about the existence of mental representations and the idea that they play a part in causally explaining behavior. However, mental representations might be understood literally or fictionally. This opens up the possibility that even if mental representations do not, in fact, literally exist, positing them may still play some other crucial explanatory role in our accounts of cognition. However, its proponents encounter other powerful worries – such as explaining what ultimately grounds the content of the models that posit mental representations if not mental representations.