

Extended cognition

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Article Summary

Extended cognition takes the idea that your mind is ‘on’ your smartphone literally. It says that human cognitive states and processes sometimes spill outside our heads and into objects in our environment. Alleged examples include not just smartphones, but also use of simpler technology (pencil and paper to perform a calculation), our own body (ticking off our fingers when we count), and other people (our spouse who remembers appointments so we don’t have to).

There are three main arguments for extended cognition.

Functionalism arguments rely on similarities in functional structure between extended processes and (actual or possible) internal cognitive processes. Cognition extends because the physical mechanisms that support it ‘work the same way’ in both cases. *Inference to the best explanation* arguments canvas the benefits that extended cognition would bring to psychology. We should believe that cognition extends because it would make our psychological theories more unified, elegant, and fruitful. *Second-wave* arguments emphasise the ways in which our brains integrate with our environment. Cognition extends because brains, bodies, and environment are so tightly intertwined that, when we solve certain cognitive tasks, they count as a single system.

Extended cognition is attacked on many fronts. It has been claimed that it generates *absurdly high levels of extension* (‘cognitive bloat’); that it is inferior to the more conservative hypothesis of *embedded cognition*; that its arguments confuse *causal*

coupling with constitution; and that its alleged cases fail to satisfy some proposed *mark of the cognitive*.

Extended cognition concerns only the cognitive, information-processing aspects of mental life. It has, however, inspired similar claims about extension for other aspects of the mind, including conscious experience, emotions, moods, intentional agency, knowledge, and the self.

Extended cognition is part of a wider ‘4E cognition’ research programme. The four Es stand for extended, embedded, embodied, and enactive cognition. Each E offers a closely related, albeit distinct perspective on the role of the environment in cognition. Other forms of externalism about the mind – [content externalism](#), [direct realism about perception](#), [collective intentionality](#), and [group cognition](#) – are less closely related to extended cognition.

1 Extended cognition

Humans love their devices. Smartphones, tablets, computers, paper notebooks, calendars, and to-do lists play a pervasive role in our lives. These pieces of technology cause us to think and to behave in certain ways, and we in turn modify them to influence our future thought and behaviour. Often we don’t appreciate how much we rely on them until they’re gone. Empirical work in psychology suggests that this dependence runs very deep. Even during relatively undemanding tasks – e.g. copying a simple coloured pattern made of puzzle pieces – we off-load information processing onto the environment to reduce work for our brains (Ballard et al., [1997](#)). Once one recognises this, one sees it everywhere: a bartender lines up cocktail glasses of different shapes to remember a complex order; a mathematician uses pencil and paper to guide their steps in a calculation; a child uses their fingers to count off the days until their next birthday. These observations reveal that intelligent, adaptive human thought and behaviour need not always be produced by the brain alone. It often involves a two-way interaction between the brain, body, and world (Dennett, [1996](#); Hutchins, [1995](#); Simon, [1969](#)).

The hypothesis of extended cognition (HEC) goes beyond this relatively uncontroversial observation in a controversial way. Environmental processes don’t merely interact with our brain to produce thought and behaviour. Those environmental processes *have as much claim to be mental or cognitive* as their brain-based collaborators. Human cognition literally extends into smartphones, tablets, notebooks, to-do lists, and cocktail glasses.

HEC Some actual human cognitive states/processes extend outside our brains to include, as parts, states/processes in the environment.

HEC is frequently misunderstood, so it is worth taking care here.

HEC applies the slightly puzzling concept of ‘extension’ to cognitive processes. It is important to realise that HEC is not a claim about cognition considered in some abstract non-physical sense, or about cognition considered from a first-person phenomenological point of view. It is a claim about cognition’s physical, mechanistic basis. That physical basis has a location and an extent. Traditional wisdom has it that the physical basis of human cognition (its ‘realiser’ in functionalist terms) is located exclusively inside the human brain. HEC says that this is false: a mixture of brain and environmental states/processes underlie (realise) cognition.

What counts as the ‘environment’ may not always be precisely defined. For our purposes, the environment is anything outside the brain or central nervous system. Thus, your cognitive processes might extend into external technology (smartphones, notebooks), your non-neural body (fingers, limbs, tendons), naturally occurring objects around you (useful sticks and stones), tokens of public language (appropriate sound waves and ink marks), or the brains of other people (your spouse).

There are several claims that are often mistakenly associated with HEC.

HEC does not say that the environment is as important as the brain for cognition. The brain may remain the principal player behind our thought and behaviour. What HEC says is that the brain is not the *only* player: it is not the sole locus of human cognition (see Clark, 2007a, on ‘organism-centered’ cognition). HEC does not say how much of cognition extends. It is compatible with some, even most, of our cognitive life being wholly internal and brain-based. Only some instances of human cognition need extend for HEC to be true. HEC is also silent about whether extended cognition is a good thing for the agent in question. Sometimes it is (e.g. when a smartphone increases your memory capacity or improves your calculating ability), but sometimes it isn’t (e.g. when a smartphone sustains unhealthy cognitive biases or pathological worries about your self image, see Sprevak, 2011; Borsboom, Cramer and Kalis, 2018). HEC similarly says nothing about whether extended cognition is the outcome of a voluntary choice by the agent (or anyone else). We may be drawn into entanglements with the environment without our awareness or consent. Finally, HEC does not say anything about whether external objects have an independent mental life of their own. As far as HEC is concerned, a smartphone sitting by itself need have no more mental life than an isolated neuron sitting inside a Petri dish. It is only when a smartphone (or a neuron) stands in the right relationship to the rest of our brain that it becomes part of our cognitive life and endowed with mental/cognitive properties.

2 Arguments for extended cognition

There are three main arguments for the hypothesis of extended cognition (HEC). All of them appear in Clark and Chalmers' (1998) classic paper and each can be illustrated using their thought experiment:

Inga has normal human memory. One day, she hears of an interesting exhibition at the Museum of Modern Art (MoMA). Inga thinks, recalls that MoMA is on 53rd Street, and sets off. Otto suffers from a mild form of Alzheimer's disease and he always writes down useful information in his notebook. On the same day, Otto also hears of the exhibition at MoMA, retrieves the address from his notebook, and sets off.

Clark and Chalmers say that Otto has a belief that MoMA is on 53rd Street. This belief – and Otto's cognitive processes associated with storing and recalling it – extends outside Otto's brain and into his notebook. Before proceeding to the arguments, it is worth noting that this is not meant to be a realistic description of Alzheimer's disease or any actual real-life case. Clark and Chalmers are describing an idealised set of interactions with the environment that they say *would* give rise to extended cognition. They claim that more complex versions of these interactions occur in common real-life cases (e.g. smartphone use) and similar arguments could be given for these more complex cases to those given for Otto and Inga below.

Functionalism arguments. The claim here is that Otto and Inga are identical in a way that matters to functionalism. **Functionalism** is a philosophical theory that says that the functional role of a physical state/process determines whether that state/process is mental/cognitive. Functionalism about beliefs says that what makes a brain state a belief is that it functions in a way appropriate to a belief. Clark and Chalmers observe that Otto's notebook functions for him in roughly the same way as Inga's biological memory functions for her. The state of Otto's notebook interacts with his desires and other beliefs in a manner similar to that in which the state of Inga's biological memory interacts with her desires and other beliefs. Exposure to new information causes Otto to modify the state of his notebook. Exposure to new information causes Inga to modify the state of her biological memory. Otto's notebook causes him to stop at 53rd Street. Inga's biological memory causes her to stop at 53rd Street. The 'coarse-grained' functional role of the stored information appears to be the same in both cases. Clark and Chalmers conclude that just as Inga has a belief that MoMA is on 53rd Street, so Otto has a belief (partly realised in his notebook) with the same content.

This argument relies on accepting functionalism about beliefs, and also on the 'parity principle':

If, as we confront some task, a part of the world functions as a process which, *were it done in the head*, we would have no hesitation in recognizing as part of the cognitive process, then that part of the world *is* (so we claim) part of the cognitive process. (Clark and Chalmers, 1998, p. 8, emphasis in original)

The parity principle says that we should not be prejudiced against treating Otto's notebook as a realiser of one of his cognitive states merely because it is outside his head. Recent versions of the functionalist argument for HEC use the parity principle to block an objection to the original functionalist argument: Otto's notebook and Inga's biological memory are not *exactly* alike in their functional roles. This flaw was pressed by early critics of HEC (Adams and Aizawa, 2001; Rupert, 2004) and cited as a reason to think that Otto's notebook and Inga's biological memory don't have the same claim to mental status. However, although Otto and Inga are not exactly functionally alike, Otto *is* functionally identical to a hypothetical intelligent being who uses a notebook inside its head to store information (e.g. an extraterrestrial who uses internal ink-marks to encode some of its memories). If it is *possible* for an intelligent being to have a fully cognitive internal memory system like Otto's notebook, and we accept the parity principle and functionalism, then we should say that Otto's *actual* notebook counts as a case of extended cognition. (For a discussion of this argument, see Sprevak, 2009)

Inference to the best explanation. The idea here is that HEC affords some *explanatory advantage* to psychology. The argument takes the form of an *inference to the best explanation* (IBE): we should believe that HEC is true because of the explanatory benefits its acceptance would bring to psychology. Clark and Chalmers say that HEC would unify otherwise unrelated patterns of human thought and behaviour. Otto's and Inga's cases illustrate this point. Inga arrived at 53rd Street because she *wanted* to go to MoMA and *believed* that it was there. Assuming HEC is true, Otto arrived at 53rd Street because he *wanted* to go to MoMA and *believed* that it was there. HEC allows us to explain both agents as falling under the same belief-desire psychology, irrespective of whether they use internal or external resources for their information storage. Always explaining Otto's behaviour differently from that of Inga, and in terms of Otto's internal beliefs *about* his notebook, seems to introduce needless complexity. The notebook is a constant in Otto's life, similar to Inga's biological memory. At least for certain explanatory purposes, it seems redundant to always point to the notebook when explaining Otto's behaviour. Accepting HEC arguably makes the notion of belief in psychology 'deeper and more unified, and ... more useful in explanation' (Clark and Chalmers, 1998, p. 14). (For a discussion of this argument, see Sprevak, 2010)

Second-wave arguments. These arguments tend to downplay the considerations be-

hind the functionalist and IBE arguments and instead emphasise ‘complementarity’. What is meant by this is that external states and processes need not be similar – either functionally or in terms of their role in psychological explanation – to any internal ones. What justifies HEC is a tight, reciprocal *integration* between brains, bodies, and the environment. This approach has affinities with dynamical systems theory, which models the brain, body, and environment as a single system whose elements cannot be prised apart when solving a cognitive task (Thelen and Smith, 1994). In their original paper, Clark and Chalmers call this position ‘active externalism’: all parts (internal and external) are ‘active’ in the sense that they work together in a non-redundant fashion to solve a cognitive task. The resulting interaction need not be similar to any (actual or possible) internal cognitive process, and there is no reason why it should be treated as such in psychological explanation. Otto’s notebook isn’t cognitive because it is functionally like Inga’s memory, or because it is explanatorily beneficial for psychologists to group them together. Otto’s notebook is cognitive because it is systematically, reciprocally, and inextricably integrated with his brain during certain cognitive tasks. This integration is intended, at least in certain cases, to have a normative dimension: it arises from, and it is maintained by, social practices, norms, and institutions. (For a reconstruction of second-wave arguments, see Menary, 2010a; Sutton, 2010) (Note that talk of a ‘second wave’ may suggest that the ‘first wave’ was a failure, but it is by no means clear that either the functionalist or IBE argument cannot be made to work, or that all three arguments for HEC cannot be combined into a unified package.)

3 Objections to extended cognition

The hypothesis of extended cognition (HEC) has, unsurprisingly, encountered considerable resistance. Here are four common objections.

Cognitive bloat. Fans of HEC say that human cognition extends in certain cases and to a certain degree, but they usually want to avoid claiming *too much* cognitive extension. Too much extension might make our existing mental concepts pointless, absurd, or otherwise unfit for purpose. We might end up saying you believe everything on the Internet or that you and I believe the same things just because we happen to live in the same environment. This is called the problem of ‘cognitive bloat’. Avoiding cognitive bloat requires drawing some principled line between those relationships with the environment (functional/explanatory/integrational) that entail cognitive extension and those that do not. Drawing such a line has not proved easy. Consider that not only your smartphone, but also your office computer, local library, friends, co-workers, and in many cases the whole Internet contain information on which you routinely draw to guide your behaviour in a way not dissimilar to that in which Otto relies on his notebook. Consider too that when you

and I live in the same environment, we often draw on the same set of environmental resources to guide our respective behaviours. An argument for HEC needs to guard against becoming a *reductio ad absurdum* of the view. Introducing restrictions to avoid cognitive bloat, however, may cut against the assumptions required to motivate any form of HEC at all – for example, they may violate the parity principle (see Sprevak, 2009).

Embedded cognition. The hypothesis of embedded cognition (HEMC) is an alternative to HEC that claims to offer all of the latter's explanatory benefits but without the 'cost' of saying that notebooks have mental/cognitive properties. HEMC and HEC agree on almost all points: extended processes are functionally similar to internal cognitive processes; grouping extended and internal processes together is sometimes useful in psychological explanation; brains are integrated with the environment when we solve certain cognitive problems. HEMC and HEC differ in that HEC says that extended cognitive processes are 100% mental/cognitive whereas HEMC says that only the internal, brain-based parts of those processes are mental/cognitive. According to HEMC, extended processes are composed of separate mental and non-mental parts – and the mental parts reside exclusively inside the head. According to HEC, extended processes have a uniformly mental/cognitive nature inside and out. Critics of HEC argue that we should abandon HEC for HEMC because the latter provides the explanatory benefits of the former but it is more ontologically parsimonious (it attributes fewer mental/cognitive properties to the world) and it is more conservative (it fits better with traditional internalist psychology) (see Rupert, 2004; Sprevak, 2010).

The coupling/constitution fallacy. Arguments for extended cognition often describe a two-way causal coupling between our brains and the environment. One might be tempted to say that cognition extends *because* of this coupling relationship. However, just because X and Y are causally coupled does not mean that X is part of Y. The expansion of a bimetallic strip in a thermostat is coupled to the motion of atoms in the surrounding air in the room, but that does not mean that the strip's expansion is a process that extends into the atoms of the air (Adams and Aizawa, 2007, p. 91). Similarly, your brain and the environment may be causally coupled but that does not mean that your brain processes extend into the environment. This objection appears to most directly threaten second-wave arguments for extended cognition, since those arguments emphasise two-way causal coupling between the brain, body, and environment. An advocate of HEC needs to find something beyond mere coupling that justifies cognitive extension. A natural resort would be to appeal to either the *explanatory value* of treating the coupled system as cognitive or the *functional similarity* between the coupled system and an internal (actual or possible) case of cognition. However, this would collapse second-wave arguments into their first-wave versions (see Adams and Aizawa, 2001; Adams and Aizawa, 2007).

Alternatively, a second-wave defender of HEC might stress the normative nature of the coupling relationship and explore how this might render the relationship constitutive rather than merely causal.

The mark of the cognitive. A ‘mark of the cognitive’ is a set of necessary or sufficient conditions for a physical state/process to be cognitive. A mark of the cognitive is often sought as a way of overcoming disagreements between philosophers about HEC. If one could agree on a mark of the cognitive, one could use it to decide whether disputed cases (like Otto’s notebook) really are cases of extended cognition. Proposed marks of the cognitive tend, however, to be at least as controversial as the cases they are supposed to help decide. Various marks of the cognitive have been proposed, including: (i) a cognitive process must involve non-derived representational content and be functionally similar to actual cases of internal, brain-based human cognition (Adams and Aizawa, 2007); (ii) a cognitive process must be part of an integrated, persisting system, and it must causally contribute to a wide range of cognitive phenomena (Rupert, 2009); (iii) a process is cognitive so long as it ‘belongs’ to a subject in the sense of causally contributing to the intentional content of that subject’s personal-level states (Rowlands, 2010). Critics of HEC tend to favour conservative marks of the cognitive like (i) or (ii), which rule out many cases of extended cognition. Advocates of HEC tend to favour liberal marks of the cognitive like (iii), which allow in many cases of extended cognition. There is currently no consensus about which is the correct mark of the cognitive, and one may worry that no such set of necessary or sufficient conditions exists. Just as there seems to be no single set of necessary or sufficient conditions that determines which physical processes are *healthy*, *living*, or *cancerous*, so there might be no set of necessary or sufficient conditions that determines which physical processes are *cognitive* or *mental* (Allen, 2017).

4 Extended cognition’s kindred views

Philosophical work on the hypothesis of extended cognition (HEC) has focused not only on arguments for, and objections against, the view, but also on tracing HEC’s connections to other claims about the mind. Two types of kindred view stand out: claims about *other aspects of the mind extending* and *other forms of philosophical externalism about cognition*.

Other aspects of the mind extending. Clark and Chalmers (1998) restricted their claim about extension to the cognitive, information-processing aspects of the mind (e.g. storage and retrieval of dispositional beliefs). They flagged up conscious experience as an aspect of the mind that is likely to escape their arguments; conscious experience could be entirely brain-based. Noë (2004) disagrees. Using variants of

the IBE and second-wave arguments of §2, Noë argues that the physical mechanisms of consciousness extend outside the brain and into the body and environment. Clark (2009) replies that while such extensions are theoretically possible, they are unlikely to happen because our brain's causal interface with the world (our eyes and our hands) has a narrow bandwidth which (information-rich) conscious experience cannot cross.

Consciousness is not the only source of novel claims about mental extension. Carter, Gordon and Palermos (2016) say that emotions extend when the physical processes involved in their *cognitive-appraisal* component extend. Colombetti and Roberts (2015) argue that all kinds of affective mental states (emotions, moods, sentiments, and temperaments) extend when external objects are used to regulate them. Vierkant (2014) argues that intentional agency and *willpower* extend. Pritchard (2010) and Carter and Kallestrup (2016) explore extension claims for epistemic states like *knowledge*. Clark (2007b) argues that the self extends. Essays in Anderson et al. (2018) explore extension claims about other aspects of the mind, including processes that differ significantly from the task-based, problem-solving examples favoured by Clark and Chalmers (e.g. friendship and imaginative engagement with a text).

Other forms of externalism about cognition. HEC is often described as part of a wider research programme called '4E cognition'. The other Es are *embedded*, *embodied*, and *enactive* cognition. We have already met *embedded* cognition with the hypothesis of embedded cognition (see §3). *Embodied cognition* says that cognition depends in some way on the physical nature of our bodies. Different versions of embodied cognition cash this claim out differently. In some versions, embodied cognition simply expresses a body-based version of HEC: cognition depends on our body when our physical bodies partly realise our cognitive processes (e.g. when a child counts on her fingers, her mathematical cognising extends into the physical movement of her fingers). However, embodied cognition may also be used to express other forms of externalism about the mind. Lakoff and Johnson (1999) say that the specific shape of the human body influences the semantic content of our concepts, including abstract logical and mathematical concepts. This is something about which HEC is largely silent. *Enactive* cognition says that cognition consists in a looping interaction between perception and action that involves brain, body, and world. This has obvious affinity with second-wave arguments for HEC (see §2), but specific versions of enactivism might differ in various ways from HEC about how they see this integration working. Some enactivists reject HEC's framing in terms of representations and information processing: 'sensorimotor' enactivists say that cognition consists in implicit, non-representational bodily skills (Noë, 2004); 'autopoietic' enactivists say that cognition consists in biologically inspired relationships, such as autopoiesis, adaptivity, and sense-making (Di Paolo, 2005).

HEC has a more distant relationship to other kinds of philosophical externalism, such as content externalism, direct realism about perception, collective intentionality, and group cognition. [Content externalism](#) says that the representational content of our cognitive states does not supervene on the internal physical state of our brains. HEC has almost nothing to say about this. HEC's claim is about the location of the physical vehicles of cognition, not about the factors that determine their representational content (Hurley, 2010). [Direct realism about perception](#) says that perception involves a perceiver standing in a special 'perceiving' relation to a real external object beyond her brain. HEC assumes almost nothing about whether this view is correct. Indeed, HEC is frequently stated in intentionalist (as opposed to direct-realist) terms. [Collective intentionality](#) is the claim that groups of individuals sometimes have shared mental states, such as belief, knowledge, and intention. Closely related to this is the notion of [group cognition](#): a cognitive state or process that is properly attributed to a group of individuals rather than to the individuals that compose that group. While both of these last views agree with HEC that cognition is not found exclusively inside individual heads, HEC is a claim about individual human cognition extending, not about shared or group cognition.

HEC may be combined with a variety of other externalist claims about the mind, but it makes a separate, unique claim about how the human mind spreads out into world.

Related Articles

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- Metaphysics of knowledge

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