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Technology and the extended mind

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The concept of extended mind involves the idea that the use of various tools, artifacts or aspects of the environment can facilitate, enhance, or even constitute cognition. The two primary examples of the extended mind given in the now classic paper, "The extended mind," by Clark and Chalmers (1998) involve different types of technology. In one example a player adjusts the positions of shapes on a computer screen through the manipulation of a computer mouse to supplement or replace use of the imagination in order to facilitate the playing of the game Tetra. In the second example, Otto, a person with memory problems, utilizes a somewhat older form of technology, pencil and notebook, to record, store, and retrieve his memories. Technologies can operate as vehicles of cognition in ways that supplement or replace neural mechanisms as we attempt to remember, or imagine, or think through solutions to problems. Accordingly, our cognitive abilities (and the cognitive processes themselves) are extended, and perhaps constituted by the use of various aspects of the environment, and more specifically by technologies.

The parity principle

Although there are a number of philosophical debates about the nature of the mind in the extended mind literature, technology is consistently understood to play an important role in the various positions defended by extended mind theorists. In the original version of the extended mind hypothesis (EMH) the relevant technology is treated in parity with processes that occur in the head or brain, in conformity with the parity principle, which states:

> 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 & Chalmers 1998, 8).

According to this account, engagement with a particular piece of technology can be part of the cognitive process, on parity with brain processes. This view is referred to as 'active' or 'vehicle' externalism, understood in terms of the distinction between the content and the vehicle of cognition (Dennett 1969; Millikan 1991). According to EMH, the vehicles or material mechanisms of cognition are not just neurons, but may include instruments or artifacts in the environment. 'Active' externalism registers both "the active role of the environment" and active engagement on the part of the cognizer. To the extent that internal representations play a role, they are action-oriented representations which set the stage for engagement with the material environment (Clark & Toribio 1994). Kirsh and Maglio (1994) call this 'epistemic action'. For example, in playing the game Tetris, a player might have the following options:

(a) activate neurons in order to mentally rotate the geometric shapes she sees on the computer screen, or
(b) activate a neural implant in her brain to physically rotate the geometric shapes, or
(c) physically manipulate the geometric shapes using a rotate button on the computer.

According to the parity principle, these processes would be more or less equivalent. Option (c), as an epistemic action, can simply substitute for (a) or (b).

In response to worries about the reliability of technology and the portability of external tools and artifacts, in contrast to the brain, Clark and Chalmers emphasize that although the brain may come to depend on specific types of technology, it is also the case that the cognizer may have the capacity to couple systematically with a wide variety of elements. This can provide cognitive flexibility. Also, if we can think of language as a technology, it tends to be a reliable and important tool that expands our cognitive capacity (see Rupert 2010).

The most contentious objection to the EMH concerns the idea that use of an external artifact or piece of technology "constitutes" cognition, or more controversially put, constitutes the mind. What follows from this kind of claim are worries about the boundaries of the mind (where the mind begins and ends), about the 'mark of the mental' which would define those boundaries (Adams & Aizawa 2001), and about cognitive bloat, where there seems no limit at all to the mind (Rupert 2004; Rowlands 2009). In contrast to any claim that the mind is constituted not only by brain processes, but also by processes of engagement with whatever equipment might be put in service of cognition, the alternative is to simply take the external technology as causally related to cognition, enabling it but not constituting it. Giving up the constitution claim and retaining the causal claim would still allow one to speak metaphorically about extending the mind without running into ontological difficulties – that is, having to claim the mind includes parts outside of the head. One would thus avoid the causal coupling-constitution fallacy, as Adams and Aizawa define it, a problem of confusing causality with constitution.[1]

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[1] The strict distinction between causality and constitution derives from new mechanist theory (e.g., Craver 2007). On the latter view, constitution is a mereological relation that requires a simultaneity of parts and whole; causality, in contrast, involves diachronic processes. An alternative definition of constitution as diachronic or dynamical, that does not require a strict exclusion of causal processes, however, dissolves the objection and avoids the fallacy (see Gallagher 2018a, Kriegel 2017; 2018, Kirchhoff 2012).

Clark (2008; 2010), retaining the strong claim of constitution, appeals to what are called the "trust and glue" criteria to address some of these concerns. These are criteria that need to be met by external physical processes if they are to be included as part of an individual's cognitive process. He lists three such criteria.

1. That the external resource be reliably available and typically invoked.
2. That any information thus retrieved be more-or-less automatically endorsed. It should not usually be subject to critical scrutiny (unlike the opinions of other people, for example). It should be deemed about as trustworthy as something retrieved clearly from biological memory.
3. That information contained in the resource should be easily accessible as and when required (Clark 2008, 79).

The second and subsequent waves

A friendlier, or one might say, internal objection to EMH's parity principle leads to a revised version of the extended mind, often referred to as a "second wave" of extended mind theory. Although, in some cases there may be an epistemic-functional similarity or parity between internal neural processes and external tools and technologies, there are also cases that involve significant differences, where the differences offer important and complementary functionality. Complementarity includes the idea that "different components of the overall (enduring or temporary) system can play quite different roles and have different properties while coupling in collective and complementary contributions to flexible thinking and acting" (Sutton 2010, 194; see Gallagher 2018b for further discussion). The balance implied by complementarity between the use of external props or technologies and internal processes like memorization, may alter from case to case or from situation to situation. Indeed, this balance may be modulated by structures or changes in the affordances offered by different environments, as well as differences in agents' bodies and skill levels.

If this is a departure from the parity principle, it is one that Clark allows, since, following Edwin Hutchin's (1995) view of distributed cognition, he can say "the computational power and expertise is spread across a heterogeneous assembly of brains, bodies, artifacts, and other external structures" (Clark 1997, 77), such that disparate components may co-operate to yield an integrated system capable of supporting various (often quite advanced) forms of adaptive success (Clark 1998, 99). Accordingly, there can be a kind of "soft assembly," and sometimes a temporary meshing of neural and non-neural resources to form a "highly integrated," task-specific system. In this respect, technologies, and the practices that surround different technologies, are integrated into cognitive processes, not due to some kind of automatic fit between neural processes and pieces of the environment, but because there is an active coupling through a set of reciprocal causal connections activated by active (sensory-motor) bodily manipulations of the environment (Menary 2007; 2010b). These manipulations include epistemic actions, sensory-motor contingencies (O'Regan & Noë 2001), and self-correcting actions, which may include both the use of technology and cognitive practices which involve "the manipulation of external representational and notational systems according to certain normative practices – as in mathematics" (Menary 2010a, 237; see 2010b; 2012). That is, the use of numbers, diagrams, drawings, maps, charts, etc., operating as external representations, allow for the accomplishment of cognitive tasks. Furthermore, we manipulate our technologies (from pencils and paper to computers), following norms that are culturally established and learned. According to Menary, these practices and normative factors are integrated with the internal activities of our brains and mediated by the movements of our bodies.

The emphasis on social and cultural practices also suggests something that remained implicit in the original proposal of the EMH, namely that those practices, and the social relations they involve, are also extensive for the mind. One can think of this in a bottom-up fashion, in terms of the formation of collective intentionalities emerging from the interaction of agents who, by working together, depend on one another to expand their cognitive capacities and epistemic affordances (see De Boer 2021) One can also think of this in a top-down fashion, in terms of established institutions that provide support for cognitive operations (Gallagher 2013). These are cognitive institutions like the legal system, an educational system, the institution of science, etc., that allow for expansive social organization and the advancement of knowledge. Like the technologies that they typically use, such institutions can both expand possibilities for acting and thinking, or constrain and narrow them.

Changing your mind

If we think of the mind as extended by technologies and the practices and institutions that surround technologies, then one clear principal is that changing technology changes the mind. This is nothing new. We find the idea in Hegel as well as Marx; and more recently in post-phenomenology (Ihde 1979; 2009) and material engagement theory (Malafouris 2013). As Ihde and Malafouris (2018, 1) indicate:

> Humans, more than any other species, have been altering their paths of development by creating new material forms and by opening up to new possibilities of material engagement. That is, we become constituted through making and using technologies that shape our minds and extend our bodies. We make things which in turn make us. (2018, 1).

Technology, in effect, is not neutral; as a product of human activity it is "always (whether consciously or unconsciously) determined through norms and values" (Loh 2019, 9), and, we might add, determining of norms and values. Since the EMH expresses a form of embodied cognition, it is important to note that, materially, technologies of all sorts have direct effects on our bodies. On one view, expressed by Marx and Engels, the human body is an appendage to the machine (Synnott 1993, 24). In this respect, however, it can be the institutional (social and political) arrangements that make it so. The use of technologies within specific institutional frameworks can in fact constrict cognition and limit our affordances. It's not just the arrangement of task-related operations in the factory, as Marx and Engels were thinking; in more contemporary scenarios, it may be the embodied practices associated with social media and communicative technology that create the constraints on our thinking capacities. Web-based technologies (what Smart [2012] calls 'web-extended mind'[2]), for example, can have a direct effect on how we perceive the world, or how we conceive of our social relations. These are technologies that get incorporated; they get "inside our heads" and constrict our abilities to even recognize problems. At the same time they may be open to manipulation by others, posing a threat to autonomy and privacy (Reiner & Nagel 2017).

Ethical issues aside, such technologies change minds. That is, literally, they change the way that we perceive the world, or change the way that we think about things. A nice example is given by Michael Wheeler (2019) – "North Sense" (now called "Sentero") a small wearable piece of technology that vibrates gently when it faces magnetic north (https://cybor gnest.net/produ cts/ the-north-sense, last accessed 5 October 2021). As Wheeler explains, first-person reports suggest that North Sense "quickly becomes deeply integrated into the wearer's cognitive life. Most strikingly, orientation and position start to play a bigger-than-usual role in the structuring of memory" (2019, 857). He quotes Scott Cohen, who describes this phenomenon as follows: "It is hard to put into words only a few hours after attaching the North Sense, but the feeling I am left with is profound. The impact of immediately sensing my position created a permanent memory. I vaguely recall the colours and sounds in the room, but I remember my position vividly." Wheeler suggests, this alters cognitive processing. Regardless of whether one adopts the constitutional view of extended mind, or simply a causal view, the principle is the same: the mind itself changes as we engage with technology.

According to Clark and Wheeler, however, it is the constitutive relation that allows us to count a piece of technology as part of an extended mind. The example of North Sense can also help us understand how to think of this constitutive relation, since it is an example of a technology that quickly becomes transparent or incorporated. That is, it becomes experientially invisible so that the agent gets directly to the experience without noticing the technology. For Clark, Wheeler, and others, this kind of transparency is a necessary condition for a truly extended mind, i.e., the case in which the agent's engagement with the technology constitutes her cognitive processes (Clark 2008, 27-38; Wheeler 2019; Carter et al. 2018).

The transparency requirement

Wheeler summarizes this view with what we can call the transparency requirement:

> When a tool is transparent, that is a necessary condition met for its constitutive incorporation into the user's mental machinery. When a tool becomes visible, due to, for example, damage or malfunction, or when, as in the case of some sensory

[2] Smart et al. (2008, 2) call this 'network-enabled cognition' and define the "thesis of network-enabled cognition: The technological and informational elements of a large-scale information network can, under certain circumstances, constitute part of the material supervenience base for an agent's mental states and processes."

> substitution subjects, a deliberate, conscious effort on the part of the user resets the mind-world boundary at the skin, that means that cognitive extension is no longer operative. (Wheeler 2019, 862)

There are some technologies that follow the opposite logic. In contrast to the term 'incorporation', as it is used to describe how some technologies becomes transparently integrated with the body (Clark 2008; De Preester & Tsakiris 2009; Nourrit & Rosselin-Bareille 2017), Butnaro (2021) argues that some technologies which are not incorporated or transparent, nonetheless *extend* bodily and embodied mental capacities. She provides a detailed analysis of exoskeletal technology (ET), i.e., robotic enhancements of the body, and argues that these are embodied extensions rather than incorporations. They do not become experientially transparent for the user, as some prosthetics do. In this respect, they are similar to smartphones and computers which are epistemic extensions, allowing us to store knowledge, "outdoors," so to speak, but also allowing easy access to that knowledge. Rather than *ego cogito*, through such technology we engage with *exo-cogitans*.

In contrast to Butnaro, Clark (2008, 37-38; 74ff) and Wheeler (2019) would deny that non-transparent technology can be truly constitutive of extended cognition. On the transparency requirement, transparency is the measure of extension. Clark and Wheeler acknowledge that human cognition employs both kinds of technology, transparent and non-transparent, even if only the transparent kind can be truly constitutive of extended mind. Like Butnaro, Clark appeals to the example of technologies that extend the capabilities of the body to make his point. Experiments show rapid changes in neuronal processing when macaque monkeys learned to use a rake to reach their food. Such neuronal changes, reinforced by behavioral measures, are usually interpreted to mean that perception of peripersonal space changes to include space as far as the rake can reach; this change is also formulated as the tool being incorporated into the body schema, "as if the rake was part of the arm and forearm" (Maravita & Iriki 2004, 79). The idea that one can become fluent or skilled at using such a tool, to the point that it results in plastic changes in one's brain, is evidence that the tool has become transparent or incorporated – part of the body schema, and not just causally related to it. In the same way, that is, appealing to the transparancy requirement, Clark suggests, human minds can be "genuinely extended and augmented by cultural and technological tweaks" (2008, 39).

For Wheeler, the issue is framed by a concern about the use of deep-learning AI systems in devices that classify information in ways that are not consistent with the classificatory norms that human agents typically use. On the one hand, use of such technology may indeed meet the experiential transparency requirement; on the other hand, and at the same time, the technology is not epistemically transparent in so far as the agent does not fully understand how the algorithm works, and is unaware that the technology may be changing his mind in unwanted ways.

> This outcome would surely have epistemic implications and perhaps moral ones too. If a deep neural network application to which I am transparently coupled qualifies as part of my cognitive architecture and thus as part of me, then the classifications in question—classifications that unconsciously guide my

> behaviour—will be part of what I unconsciously believe to be the case, and thus presumably will have the same status as my more familiar, internally realized unconscious beliefs when it comes to any moral judgments that are made about my resulting thoughts and actions. (Wheeler 2019, 864).

In such cases, Wheeler suggests, we may not want the technology to meet the transparancey requirement; it would be better if we were aware of what the technology was doing or how it was classifying information if it is doing so in an obscure or aberrant way. Rather than the model of the incorporated tool, Wheeler offers a model of conversation, following Usman Haque's proposal for high-tech interactive buildings. For Haque we would create a rapport with the technology through "conversations," where new possibilities are built on a history of interactions (Haque 2006, 3). Such human-AI interfaces would be modeled on a "constructive interactive dialogue" rather than a smooth transparent coping (Wheeler 2019, 865). One could happily endorse this model, but it comes with the proviso that a dialogical relation with technology would not constitute an extended mind in the genuine sense, specifically because it does not meet the transparency requirement.

It is not clear, however, why the transparency requirement should be the measure of constitutive status or genuine extension. In this respect the requirement is related to the trust and glue criteria mentioned above (see Clark 2008, 80). Consider, for example, the second of these criteria.

> That any information thus retrieved be more-or-less automatically endorsed. It should not usually be subject to critical scrutiny (unlike the opinions of other people, for example). It should be deemed about as trustworthy as something retrieved clearly from biological memory.

Of course, biological memory is not always trustworthy, although we may not normally give it much critical scrutiny. If we did give it critical scrutiny, would that make it less genuinely a cognitive process? It would seem that on this criterion, as well as the transparency requirement, any type of cognitive activity that required critical scrutiny would simply disqualify the activity from being considered a genuinely extended cognitive process. Even if I usually engage in critical reflection or a metacognitive heedful attitude – perhaps I'm a habitual skeptic – why should that disqualify any processes that would otherwise count as cognitive. Critical reflective scrutiny is simply another cognitive process, so it seems odd to think that by adding a cognitive process like reflection to a process that otherwise would count as cognitive, it suddenly makes that process non-cognitive. Likewise for any use of technology that would normally count as constitutive for extended cognition, the fact that, as I am using it, I take a critical perspective on it, making it less transparent – perhaps, for example, reflecting on, or even conversing with another agent about what the AI device that we are using may be doing to our scientific project – should not undermine its status as an extended cognitive performance. Indeed, in typical instances of problem solving it is important to take a critical metacognitive perspective on how one is going about solving the problem. Such reflection on methods, tools, or on my use of a particular technology will make all such cognitive doings less than transparent. We can also note that such critical processes may sometimes involve certain institutional or collective practices that require conversation or communicative actions, and such practices may be even more trustworthy or reliable, than biological memory.

The upshot, then, is that there is good reason to question the transparency requirement as a measure of the extended nature of cognition. Just as in the process of writing this paper I may engage in a kind of metacognitive evaluation of the argument I am constructing, so I could also engage in a reflective evaluation of my practice as I am using Google Scholar to locate other arguments, or to trace the development of arguments about the extended mind. Neither kind of reflection, even if it makes the cognitive processes more "visible" and less than transparent, should disqualify those processes from being part of my extended cognition, or make them no longer genuinely cognitive.

Conclusion

I've reviewed several versions of the extended mind hypothesis, and its connection to the epistemic use of technology, as well as issues that pertain to the claim that, in some sense, use of technology may constitute cognition. It is clear, at least, that the use of certain technologies can change our cognitive processes, including perception, memory and imagination. I've also questioned whether the transparency requirement is a true requirement for the extended mind, and I've argued that it is not. Cognition, whether extended or not, is not always experientially transparent. We often deliberate, make decisions, and solve problems in ways that involve conscious reflection on our thought processes, and sometimes we make such processes "visible" in collective reflection, conversation, and interaction with others. Indeed, such reflective considerations may be important for evaluating the ethical use of technologies that extend the mind.

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