Fred Adams and Ken Aizawa, The Bounds of Cognition

Blackwell Publishing Ltd., Oxford, 2008, £45.00, ISBN 9781405149143 (cloth), xiii + 197 pp

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In his 1991 paper 'Intelligence without Representation', Rodney Brooks famously criticized the intellectual core of what then was mainstream cognitive science—the 'rules and representation' approach of classical AI and the 'distributed representation' approach of connectionism. Being interested only in abstract programs for specialized feats of reasoning and inference in narrow domains, Brooks maintained, these approaches cannot do justice to the full breadth of the cognitive. Rather, we must seek to understand how real, physically embodied agents engage in 'online cognition', i.e., how they achieve sensorimotor control in real-time interactions with the environments into which they are embedded. The idea that cognition emerges out of dynamical interactions between embodied cognitive systems and their environments already significantly transcended the early model of the mind as a computational system implemented in the brain, but it still was conservative insofar as cognitive processes

remained tied to the system: what goes on in a system, cognitive-wise, may depend upon what is 'out there', but whatever it is that is going on, it is still going on 'in here', within the bounds of the system.

In 1998, Andy Clark and David Chalmers' Analysis article 'The Extended Mind' challenged that last piece of cognitive conservatism by advancing the 'Extended Mind Hypothesis' (EMH), viz., the suggestion that cognition is not (merely) intracranial but an extended process spanning brain, body, and environment. If, when solving a cognitive task, we regularly rely on external devices (like pens and paper, notebooks, laptops, PDAs, or iPhones) in tight, real-time, two-way interactions, the vehicles of the cognitive processes by which we solve these tasks may not be found solely within our brain but may include the devices themselves. Throughout the past decade, EMH has sparked a heated debate in which Fred Adams and Ken Aizawa have been its most outspoken critics. They contend that cognitive processes, embodied and embedded as they might be, nevertheless remain 'brainbound', and their arguments have now culminated in a slim book entitled The Bounds of Cognition.

In The Bounds of Cognition, Adams and Aizawa (A&A) seek to accomplish three things. First, they defend a positive account of cognition which entails that, as a matter of contingent empirical fact, cognitive processes are brainbound. Second, they argue that defenses of EMH suffer from three general problems: (1.) the lack of an adequate account of cognition which shows that cognitive processes are extended, not only possibly, but actually; (2.) the failure to appreciate the difference between a causal and a constitutive dependency between cognitive processes on the one and body and environment on the other hand (the so-called 'coupling/constitution fallacy'); (3.) the failure to distinguish the claim that cognitive systems are extended from the claim that

cognitive processes are extended. Third, they discuss and rebut five arguments that advocates of EMH have allegedly advanced in favor of their hypothesis. We will consider each of these three points in turn.

The Mark of the Cognitive. According to A&A, there are two features characteristic of cognitive processes: the fact that they involve non-derived representations and the kinds of mechanisms by which they are implemented. First, cognition requires non-derived representations, representations "that mean what they do independently of other representational or intentional capacities" (p. 31), i.e., representations of the kind ostensibly captured by naturalistic accounts of mental content like those offered by Jerry Fodor, Fred Dretske, Robert Cummins and others (pp. 36-37). The fact that "non-derived representations happen to occur these days only in nervous systems" (p. 55) is one reason to think that cognitive processes are (currently, at least) brainbound. Another reason stems from paying attention to the second characteristic mark of the cognitive, viz., the cognitive mechanisms typically studied by cognitive psychologists: since it is good scientific practice to individuate cognitive mechanisms in terms of their causal powers, the cognitive processes they implement are sensitive to the material substrate. Thus, given that brain processes materially differ from processes spanning brain, body, and environment, we have "defeasible reason to suppose that cognitive processes are typically brain bound and do not extend from the nervous system into the body and the environment" (p. 70).

We think there are various problems with A&A's account of the cognitive. First, although the assumption of internal (non-derived) representations is central to most of philosophy of mind and cognitive science, the theoretical situation regarding the nature of such representations is rather embarrassing. While there are a couple of theories in

the offing, we are far from any consensus—there simply is no received theory of how physical states come to have non-derived content. And unless we have such a theory, we will not, if we accept A&A's account of the cognitive, recognize a cognitive process if we come across one because we will be unable to say whether it is a process that involves non-derived representations. Second, unless there is a received view on the nature of non-derived content, it is hard to substantiate A&A's claim that non-derived representations are (currently) only grounded in the brain and not in the brain cum body cum environment. On some accounts this is plausible (e.g., on Dretske's information theoretic semantics, due to its evolutionary element), but others might allow for non-derived representations in non-nervous substrata (e.g., Fodor's asymmetric causal dependency account). Third, the defender of EMH can accept the indispensability of the kind of representations found in the brain and allegedly only in the brain. All she insists on is that other states (states with derived content or with no representational content at all) can also be (a non-negligible part of the) vehicles of cognitive processes (as Andy Clark puts it in his 2008 book Supersizing the Mind: cognitive processes, although not 'organism-bound', may well be 'organism-centered' [p. 139]). Fourth, A&A's claim that cognitive mechanisms must be individuated in terms of their material implementation simply begs the question against the decidedly functionalistic approach to cognition explicitly advocated by EMH.

Challenges to EMH. As outlined above, A&A identify three general problems that past defenses of EMH have suffered from. First, they urge that an adequate account of cognition be provided which shows that cognitive processes actually are extended, and they hold that advocates of EMH have not yet supplied such an account. Instead, A&A hold, they have "opted for promiscuous theories of the cognitive … [in order to] allow

such things as consumer electronics devices and grandfather clocks to count as cognitive agents" (p. 86). Second, A&A suggest distinguishing the claim that cognitive processes causally depend upon body and environment from the stronger claim that they are partially constituted by them. In what they call the 'Coupling-Constitution-Argument' for EMH (see below), there often "is a more or less subtle move from the observations about the causal dependencies between cognitive processes … and the body and environment … to a conclusion that there is some constitutive dependency" (pp. 88-89). The problem with this move, A&A maintain, is that it "does not follow from the fact that process X is in some way causally connected to a cognitive process that X is thereby part of that cognitive process" (p. 91). Third, A&A distinguish the hypothesis of extended cognitive systems from that of extended cognitive processes. They admit that the former "hypothesis that cognitive systems extend appears to be much less problematic than is the [latter] hypothesis that cognition itself extends" (p. 106). Yet, they insist, even if cognitive agents and parts of their environments form single cognitive systems, it does not follow that the cognitive processes occurring within theses systems are ipso facto also extended because "the fact that something is an X system does not entail that every component of the system does X" (p. 118).

We will address the second and third problem—the coupling/constitution fallacy and the extended cognitive processes/extended cognitive systems fallacy—below in our discussion of A&A's response to putative arguments in favor of EMH. With regard to the first problem—the lack of an adequate account of the cognitive—it seems unwise in our eyes to demand a pre-formed theory of the cognitive. Most sciences invoke concepts that lack crisp and clear definitions. Often, the content of central concepts—'gene' or 'species' in biology, say, 'wave' in physics, 'language' in linguistics, or 'computation'

in cognitive science—is not fixed prior to and independently of its theoretical and empirical fertility. Rather, the decision to adopt a particular account of, say, genes is basically strategic and depends upon the theoretical and empirical pay-offs one hopes to thereby achieve. If treating something as a gene significantly enhances our understanding of the world in a way otherwise unattainable, then scientists will, ceteris paribus, go along with it (and if not, then not). The same should, we urge, apply to the term 'cognitive': if treating a process spanning brain, body, and environment as a cognitive process proves empirically and theoretically fertile, then it is legitimate to do so. EMH may be counterintuitive, but we should not prematurely foreclose fruitful future discoveries by being overly restrictive now.

Arguments for EMH. Lastly, A&A discuss and rebut five potential arguments for EMH. (1.) The Coupling-Constitution-Argument is the well-known (see above) move from the existence of a causal dependency between cognitive and extracranial processes to the claim that cognitive processes are partly constituted by processes spanning brain, body, and environment. (2.) The Two-Step-Coupling-Constitution-Argument takes the causal dependency to establish the existence of a single (extended) cognitive system, and infers from this that the cognitive processes occurring within that system are also extended. (3.) The Cognitive Equivalence Argument argues that if processes that have traditionally been labeled 'cognitive' can occur in an equivalent way in systems spanning brain, body and environment, then these larger processes are also cognitive. (4.) The Cognitive Complementarity Argument maintains that, because brain processes are of one kind and bodily and environmental processes of another, they together achieve results superior to those achieved by just the brain alone, and that this justifies us to treat them as one single process. (5.) The Evolutionary Argument holds that if the

development of our cognitive capacities has followed the most efficient evolutionary path, which we can assume, then we should expect cognitive processes to be a hybrid combination of internal and external processes.

We have little to say about (5.). We are not sure Mark Rowlands, allegedly its key proponent, is indeed defending the argument A&A attribute to him. But if he is, their criticism seems apt: the fact that there are a number of processes (like human spermatogenesis, transcription of DNA into RNA, meiosis, mitosis etc.) which, even if their development had followed the most efficient evolutionary path, we should obviously not expect to be extended beyond the body, suggests that the if-clause in (5.) is simply false.

We are also skeptical that the complementarity of cognitive and extracranial processes that (4.) concentrates on has ever been endorsed as an argument for EMH. For instance, while Clark maintains that "[g]iven sufficient complementarity … we may sometimes confront hybrid systems displaying novel cognitive profiles" (Supersizing the Mind, p. 99), he is clearly not arguing that cognitive processes are extended because processes spanning brain, body, and environment are cognitively superior to purely intracranial ones. His point is, rather, that once "the stranglehold of vehicle-internalist intuitions concerning cognition" (ibid.) is broken—by, in his case, considerations having to do with the so-called 'Parity Principle' (see below)—then we are free to recognize "as genuinely cognitive … all kinds of process that have no fully biological analog" (ibid.). Clark's argument for EMH is based on the Parity Principle; the appeal to complementarity, as we see it, is meant only to lessen our intuitive resistance once the dogma of brainboundedness has already been dismantled.

According to A&A, (1.) fails because there is no "plausible argument for going from the causation claim to the extended cognition claim" (p. 91), and (2.) fails because even if the extended cognitive system hypothesis could be substantiated it would not follow that cognitive processes are extended (see above). Although A&A present a lot of textual evidence showing that some kind of coupling/constitution reasoning is involved, they overemphasize its role. Although both are crucial features in arguments for EMH, there is no direct inference from coupling to constitution. The constitution claim is motivated by what in Clark and Chalmers' original treatment is called the Parity Principle, viz., the claim that if a process in the world works in a way that we would not hesitate to count as cognitive were it to occur in the head, then it should count as cognitive, too. The constitution claim has to do with causal coupling only indirectly in the sense that if there were no appropriate causal coupling between an agent and an external device, we would not judge the processes spanning the agent and her environment as being such that were they to occur in the head, we would count them as cognitive. A&A's criticism of (1.) thus trades on conflating the claim that EMH is true because there is an appropriate causal coupling with the claim that EMH is true only if there is an appropriate causal coupling—as far as we can see, the defender of EMH is committed, if at all, only to the latter, not to the former. (And if there is no inference from coupling to constitution, there is, a fortiori, no two step Coupling-Constitution-Argument of the kind discussed in (2.).)

(3.) fails, A&A argue, because there are "numerous psychological differences" (p. 136) and "significant divergences" (p. 137) between ordinary cases of cognition and alleged cases of extended cognition that make them cognitively or functionally non-equivalent. However, whether this constitutes an objection to EMH depends upon

whether the differences that undoubtedly exist are at the right grain of analysis, or whether, rather, the functional similarities that undoubtedly also exist are sufficient to drive home the point of EMH.

A&A conclude their book with the contention that "there is a scientifically and philosophically motivated reason to believe that there are psychological processes that are found in brains that are unlike processes that span brains, bodies, and environments" (p. 179). In a sense, we confess: The Bounds of Cognition is the most thoroughgoing, forceful, and compelling critique of EMH so far, its case is well-argued, and advocates of EMH will have a hard time fully rebutting its arguments. However, reasons, even scientifically and philosophically motivated ones, are always defeasible. And if we are right that the claim that a process is cognitive does not involve an a priori commitment to specific kinds of mechanisms operating on non-derived representations and that what counts as a cognitive is instead dependent upon the theoretical and empirical pay-offs that are on the cards, then only further research, both empirical and theoretical, will tell whether A&A have succeeded to drive back cognition into the boundaries of our skulls. As the critical remarks above probably reveal, our suspicion is that they haven't.