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Review of *The Bounds of Cognition* by Fred Adams and Ken Aizawa. Malden, MA and Oxford: Blackwell Publishing 2008.

During the past two decades philosophers of mind, cognitive scientists and researchers from fields like robotics or dynamical system theory have argued for an *embodied*, *situated*, and *enactive* approach to cognition. In contrast to what has been taken for granted in the 'rules and representation' approach to cognition characteristic of GOFAI ('Good Old Fashioned Artificial Intelligence') and the 'distributed representation' approach of connectionists, they argue that cognitive agents cannot be fully understood without taking into account their bodies (thereby acknowledging the *embodied* nature of cognition), their environment (thereby acknowledging the *situated* nature of cognition), and their dynamical interaction with the environment (thereby acknowledging the *enactive* nature of cognition). This view, on which the environment is a crucial determinant of cognitive processes insofar as cognitive processes emerge out of interactions between cognitive systems and their environment, goes beyond a simple 'the mind as the brain' model, but is still conservative in the sense that cognitive processes are still located within the boundaries of our brains: my beliefs, memories, perceptions may *depend upon* my environment and my interaction with it, but they are not 'out there' in the environment, they are 'in here', within the boundaries of my skull.

In 1998, Andy Clark and David Chalmers abandoned this last piece of conservatism by launching a forceful attack on any approach to cognition that treats the mind as an essentially intracranial phenomenon. If I rely on a sheet of paper and a pen (or a pocket calculator, a laptop etc.) to calculate the product of 314 and 657, my calculation not only *depends upon* a dynamical causal coupling between me and my environment, i.e., my manipulation of the symbols on the paper, it is rather partly *constituted by* my manipulation of the symbols on the paper. I am linked to an external device in a tight, real-time two-way interaction: we are, effectively, a *coupled cognitive system*. As a consequence, the cognitive processing is not going on in my brain alone, but *extends* into the environment. In his forthcoming book *Supersizing the Mind: Embodiment, Action, and Cognitive Extension*, Clark describes this *Extended Mind Thesis* (EMT) as follows:

"[T]hinking and cognizing . . . may (at times) depend directly and non-instrumentally upon the ongoing work of the body and/or the extra-organismic environment. . . . [T]he actual local operations that realize certain forms of human cognizing include inextricable tangles of feedback, feed-forward and feed-around loops: loops that promiscuously criss-cross the boundaries of brain, body and world. The local mechanisms of mind, if this is correct, are not all in the head. Cognition leaks out into body and world."

EMT's suggestion that cognitive processes like belief, memory, or learning may be extended goes beyond the claim that they are embodied, situated, or enactive, and has over the past years sparked a controversial debate in which Fred Adams from the University of Delaware and Ken Aizawa from the Centenary College of Louisiana have been the most outspoken critics of EMT. In a series of articles they have argued that cognition is 'brain bound' and that cognitive processes, embodied, situated and enactive as they may be, are a completely intracranial affair. They now have put their arguments into book form, and the result is *The Bounds of Cognition*.

Adams and Aizawa's attack on EMT has three interconnected parts. First, they

defend *a positive conception of cognition* which, if correct, would entail that as a matter of contingent empirical fact cognition currently occurs only in nervous systems. Second, they identify *three difficulties* that beset the attempts made so far by advocates of EMT to spell out their position in more detail. Third, they discuss *five arguments* in favor of EMT and argue that they fail to establish that cognitive processes cross, in any significant sense, the boundaries of our brains.

Adams and Aizawa's Positive Conception of Cognition

In chs. 3 and 4, Adams and Aizawa argue for an account of cognition according to which cognitive processes are individuated by specific kinds of information-processing mechanisms that work on specific kinds of representations: "cognitive processes differ from non-cognitive processes in terms of the kinds of mechanisms that operate on non-derived representations" (pp. 12-13).

That cognitive processes involve representations is a widely held view in the philosophy of mind and in cognitive science. What Adams and Aizawa add is that cognition must involve operations on *non-derived* representations. Roughly, non-derived representations are characteristic of what Searle has called 'intrinsic intentionality', i.e., "representations that mean what they do independently of other representational or intentional capacities" (p. 31) and that are supposed to be captured by the various theories of mental content offered in the philosophy of mind, such as Jerry Fodor's asymmetric causal dependency theory, Fred Dretske's information theoretic semantics, or Robert Cummins' picture theory of mental content (pp. 36-37). Given that "non-derived representations happen to occur these days only in nervous systems" (p. 55), an assumption which Adams and Aizawa motivate in ch. 3, the claim that cognitive processes are operations on non-derived representations entails that cognitive processes are (currently) an entirely intracranial affair (although it is possible that they might cease to be—if some day non-derived representations are not only found 'in here', but also 'out there').

The second component of Adams and Aizawa's account of the 'mark of the cognitive' is that the "cognitive differs from the non-cognitive in virtue of the kinds of mechanism that are involved" (p. 57), a claim they defend in ch. 4. Cognitive psychologists try to find the laws governing and the mechanisms implementing cognitive processes, and both the laws and the mechanisms, Adams and Aizawa hold, provide us with a reason for thinking that cognition is an intracranial affair. The laws studied by cognitive psychologists support a brain bound approach to cognition because they "govern processes in the core of the brain, but not combinations of brains, bodies, and environment" (p. 61). Focusing on the mechanisms underlying cognitive processes, Adams and Aizawa maintain in an argument that, despite my best efforts continues to elude me, also supports the view that cognition is going on in brains only (currently at least), because it is good and widespread scientific practice to individuate these mechanisms not only on a functional basis but in terms of their causal powers so that the cognitive processes they implement are sensitive to the material of the mechanisms: "On the hypothesis that differences in realizer properties and processes produce differences in realized properties and processes, we have some non-question-begging, 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).

Three Problems for EMT

Problem 1. Advocates of EMT, Adams and Aizawa claim in ch. 5, ought to be able to offer an account of cognition which shows that cognition is extended, not only *possibly*, but *actually*. But as of yet, they maintain, there is no such remotely plausible theory. The main problem for advocates of EMT is

supposedly that in the attempt to defend the claim that cognitive processes can be a partially extracranial affair, they have receded to "low standards for what counts as a cognitive process" because obviously, "the more promiscuous that standards for what constitutes cognition, the less surprising it should be to find that cognition extends into the body and the environment" (p. 76). For instance, Adams and Aizawa criticize the attempt to characterize cognition in terms of information processing and in terms of computation as being too lose, because not all information processing and not all computation is cognitive processing, and the attempt to characterize cognitive processes operationally as the processes that underlie the execution of cognitive tasks, they argue, is a non-starter, because it is impossible to specify what a cognitive task is without already knowing what cognitive processes are. They conclude that "the advocates of extended cognition have *not* taken an intuitive grasp of the issue. They have, instead, opted for promiscuous theories of the cognitive that include things other than those that cognitive psychologists have traditionally concerned themselves with ... [in order to] allow such things as consumer electronics devices and grandfather clocks to count as cognitive agents" (p. 86).

Problem 2. Defenders of EMT also ought to be more sensitive to the difference between the claim that cognitive processes *causally depend* upon features of the body and the environment (a plausible claim made by many advocates of the embodied, situated and enactive approach to cognition that is explicitly endorsed by Adams and Aizawa; see ch. 10), and the claim that cognitive processes *constitutionally depend* upon features of the body and the environment. In what Adams and Aizawa call the 'coupling argument' for EMT (see below), there often "is a more or less subtle move from the observations about the causal dependencies between cognitive processes, on the one hand, and the body and environment, on the other, to a conclusion that there is some constitutive dependency between the cognitive processes and the brain-body-environmental processes" (pp. 88-89). In chs. 6 and 7, Adams and Aizawa argue that those who tacitly or knowingly make this move have little to offer to bolster it, since one cannot legitimately infer constitutional dependence from causal dependence: "It simply 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). Once attention is paid to the difference between causal dependency and constitutive dependency and to the fact that the latter does not follow from the former, Adams and Aizawa argue, it should be clear that EMT remains unaffected by any kind of evidence that can be amassed for the weaker claim that cognition causally depends upon bodily and environmental processes.

Problem 3. Advocates of EMT, Adams and Aizawa point out further, also ought to pay more attention to the difference between the claim that *cognitive systems* are extended and the claim that *cognitive processes* are extended, and to the fact that cognitive processes need not be extended only because cognitive systems are. They admit that "the hypothesis that cognitive systems extend appears to be much less problematic than is the hypothesis that cognition itself extends" (p. 106), but they insist that even if it is possible to spell out the notion of a system in such a way that brain, body, and environment do constitute a single cognitive system, it does not follow from that that cognitive processes are extended, too. Quite generally, they argue, "the fact that something is an X system does not entail that every component of the system does X" (p. 118), and therefore one cannot support EMT by arguing that a cognitive agent and parts of his or her environment form a single cognitive system.

Rebutting Arguments for EMT

The first argument for EMT that Adams and Aizawa are discussing, the one step coupling argument, is hardly an argument at all. It is the more or less subtle move,

identified in *Problem 2*, from the observation that there is a *causal dependency* between cognitive processes and the body and the environment to the claim that cognitive processes are partly *constituted by* processes that span brain, body, and environment. Adams and Aizawa dub this move the 'coupling constitution fallacy', and it is a fallacy precisely because, as said above, there is no "plausible argument for going from the causation claim to the extended cognition claim" (p. 91), and so inferring constitutional dependence from causal dependence is in general unwarranted.

The second argument for EMT is the two step coupling argument. Once again, attention is drawn to the causal connections that hold between the brain and parts of the body and the environment, but rather than inferring directly that cognitive processes are extended, it is concluded that brain, body and the environment constitute *a single cognitive system*. In a second step, it is then added, sometimes tacitly, that since there is an extended cognitive system that spans brain, body and environment, the cognitive processes within that system are also extended, and thus not brain bound. Adams and Aizawa's response is that since the extended cognitive system hypothesis does not entail the extended cognitive processes hypothesis (see *Problem 3* above), cognitive processes could be brain bound even if cognitive systems are extended, and so the second step of the argument would fail, even if the extended cognitive system hypothesis could be substantiated.

The third argument, which is discussed in ch. 8 together with the fourth and the fifth, is the cognitive equivalence argument. The idea is that processes that have traditionally been taken to be cognitive can also occur in a functionally or cognitively equivalent way in larger systems spanning brain, body and environment. Hence, since an external process that is cognitively equivalent to an internal cognitive process must itself also be a cognitive process, these larger processes also count as cognitive processes properly so called. The perhaps most famous thought experiment in this regard is that of Otto, who suffers from Alzheimer's disease and instead of his biological memory relies on extensive notebook entries. If certain conditions are met, advocates of EMT (notably Clark and Chalmers) maintain, Otto and his notebook constitute a single cognitive system that is equivalent to the biological memory system of a normal human being, Inga, and in that case the states of Otto's notebook count as his beliefs, or memories, properly so called, although they are stored not internally, but externally. Adams and Aizawa argue that the alleged cognitive equivalence is illusory since there are "numerous psychological differences between Inga and Otto" (p. 136)—Otto and Inga will fare different in a free recall task, will differ with regard to primacy and recency effects, and with regard to depth of processing effects etc. These are "significant divergences" (p. 137) that suffice to undermine any alleged cognitive equivalence.

The fourth argument, the cognitive complementarity argument, is strangely at odds with the cognitive equivalence argument. While the equivalence argument draws attention to the alleged fact that extended processes may in all important and relevant aspects be exactly like the brain bound processes that have traditionally been considered as cognitive, the complementarity argument argues that "because brain processes are of one character and bodily and environmental processes are of another, brain processes and bodily and environmental processes work well together" so that the "combination of intracranial and extracranial processes achieves results that are in some sense superior to those achieved by just the brain alone" (pp. 7-8). This complementarity of processes is then used to argue for the existence of an extended cognitive system which comprises both intra- and extracranial processes. However, Adams and Aizawa observe, since the extended cognitive system hypothesis does not warrant the extended cognitive processes hypothesis (see *Problem 3*), the complementarity argument does little to bolster EMT.

The fifth argument discussed by Adams and Aizawa, the evolutionary argument, holds that if the development of our cognitive capacities has followed the most efficient evolutionary path, we should expect cognitive processes to be "an essentially hybrid combination of internal and external processes" (p. 147). In response to this argument—which strikes me as an odd argument, and I am unsure whether this is the fault of Mark Rowlands, to which the argument is attributed, or of Adams and Aizawa's presentation of it—they point to a number of processes, including, e.g., human spermatogenesis, phosphorylation of ADP to form ATP, transcription of DNA into RNA, meiosis, mitosis, or filtration of blood in the kidneys, which, even if their development had followed the most efficient evolutionary path, we should obviously not expect to be extended beyond the body into the external world: "All are intraorganismal processes. What does it matter how efficiently they evolved" (p. 149), and they same applies, Adams and Aizawa suggest, to cognitive processes, and therefore we should not expect evolutionary theory to tell us anything about the difference between the cognitive and the non-cognitive, our about the place of the cognitive in the world.

Adams and Aizawa's conclusion in the last sentence of their book is 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). I agree. Fortunately for those who (like me) tend to find EMT plausible enough to take it seriously, and for those who (like Andy Clark or Richard Menary) fully endorse it, a 'scientifically and philosophically motivated reason' is just that, a reason, and one of the good things about philosophy is that one can acknowledge that there is a reason, even a good reason, for a position that one rejects. Advocates of EMT must undoubtedly examine the arguments and criticisms that Adams and Aizawa offer in careful detail, because *The Bounds of Cognition* is the most forceful and most convincing criticism of their position so far. Only time will tell whether it is convincing enough to drive back cognition into the boundaries of our skulls.

(Author's note: Since this review is already lengthy enough and I deemed it important to give readers of *Metapsychology* an extensive overview over the kinds of problems and arguments that are discussed in the relatively small and unknown debate about EMT, I have deliberately refrained from entering a critical discussion.)