Questioning the Bounds of Cognition
Mind as an Assemblage

ADAMS & AIZAWA'S CRITIQUE OF THE EXTENDED MIND

1.1 Bounds of Cognition

This paper takes a look at the arguments provided by some of the most vocal critics of the extended mind hypothesis, namely Adams and Aizawa, as a means to explore and ultimately support the claim that the mind can extended beyond the confines of the brain. In this view the mind can be conceived as part of a much larger system -an *assemblage*- that encompasses the brain, body and environment. We will use assemblage theory, as first put forth by Deleuze and further developed by DeLanda, to illustrate that what is important in the conception of the extended mind is the connections between the parts, not the parts themselves.

Radical **view of tool use**

In their paper *The Bounds of Cognition* Adams and Aizawa (henceforth A&A) set out to defend a form of *contingent* intracrainialism about the cognitive, whereby they admit it is logically *possible* for cognition to extend beyond the physical confines of the brain, but they claim there is no scientific proof or convincing philosophical argument to support the extended mind theory. In putting forth *universal* rules, or "*necessary conditions"* as they call them, for the mark of the cognitive and testing them against examples of extended mind cognition given by Clark and others, their aim is "*to defend common sense*"[1] and assert that cognitive capacity is brain-bound.

Their paper opens with the example of having to compute the product of two three-digit numbers. One could try to do this mentally, which would prove taxing to the memory capacity of the brain, or one could take out a pencil and paper to aid in the task which would alleviate the brain and provide a more reliable result. For defenders of the extended mind hypothesis (henceforth EMH), the use of the calculator in this example illustrates how the mind can become a tightly coupled system; working with the cognitive agent to provide a cognitive outcome. But according to A&A, tools, such as paper and pencil, allow us to move beyond the limitations of our cognitive brain capacity, to perform tasks in a more reliable and time efficient manner, but they are not part of the cognitive process. Thus

[1] Incidentally, the words "common sense" appear sixteen times in the paper

the authors find absurd what they believe extended mind theorists suggest, namely, the possibility for a cognitive process to extend to the tool. In their words:

> *"It's certainly a wild idea to suppose that to use a calculator is to have one's mind bleed out of one's brain into plastic buttons and semiconductors."*[2]

This is what the authors call *"radical view of tool use"*, a view they charge most philosophers who support the EMH with. They criticize Daniel Dennett, with his contention that we can *offload* our cognitive tasks to tools in the environment; Andy Clark & David Chalmers, with their examples of extended mind (which we will discuss further in the paper); Merlin Donald, whose theory of the evolution of human mind uses external symbol storage as constitutive of memory and thought; and Edwin Hutchins, who in studying how cognition works in everyday natural environment concludes that it is part of a larger computational system. A&A are critical of all these points of view and strongly oppose the suggestion that cognition can be a transcranial process. Tools for them are a mere aid to cognition that cannot be understood as part of a cognitive system.

In an analogy with the physical task of using a lopping shear to cut branches, A&A admit we may see human+tool as a single system but *"we still haven't the least reason to suppose that muscular processes inside the arms extend from her arms into the lopping shears*"[3]. Indeed, and as we will explore, this is not analogous to what defenders of the extended mind are proposing. Nobody is suggesting that the tool has the same muscular process as the human, but rather that the tool and human form a tightly coupled system that enables the completion of a task that neither the human alone nor tool alone could perform. This tightly coupled system is what we will explore further on as being an *assemblage* with *emergent* properties. In the meantime, we need to take a closer look at the flawed assumptions made by A&A.

With the above mentioned examples of *radical tool use* we can intuit the roots of the misconstrued assumptions A&A make regarding the extended mind hypothesis. The fallacious assumptions are twofold. First, as addressed by Clark himself, he and extended mind supporters have never suggested that extension is rampant and as frequent as regular tool use. Second, what is meant by extension does not imply that the extended object acquires the same cognitive capacities inherent in the cognitive agent. It is only under specific circumstances, exemplified through particular

[2] Fred Adams &Ken Aizawa, *The Bounds of Cognition*, p.44
[3] Ibid., p.46

hypothetical scenarios, when a tightly coupled interaction takes place and extension can occur.[4] These and other fallacious assumptions made by A&A will be discussed further on in the paper. Now let us take a quick look at two of the most discussed examples of extended cognition put forth by Clark and Chalmers[5] (henceforth C&C) and criticized by A&A.

Hypothetical scenarios of extended mind

In the first of these scenarios C&C ask us to imagine three hypothetical ways of playing a game of Tetris; in case (1) the person only mentally assesses the fit of the Tetris pieces by mentally rotating and moving the pieces seen on the screen; case (2) the person can use the above mental method or have the option to physically rotate the pieces on the screen by pressing a button; case (3) the person can use the purely mental method or aided by a neural implant can rotate the pieces on the screen just as quickly as when using a button. For C&C all three cases are similar in that all three are displays of cognition, with the only difference that case (2) occurs outside of the physical confines of the brain. The spatial location of where the process takes place cannot be the identifying feature of cognition (even A&A agree on this point) thus for C&C the case of physically rotating the blocks by pressing a button is an example of extracranial cognition.

The second scenario involves two cognitive agents, Otto and Inga who have different cognitive capacities given that Otto's Alzeimers condition obliges him to rely on a notebook where he writes down everything he needs to remember and always carries around with him. In this example when Inga hears about an exhibition at the MOMA and decides to go, she relies on her capacity for memory recall to go to the correct address. Whereas Otto, in hearing about the same exhibition needs to rely on his notebook to look up the same information that Inga could recall by memory. Clark uses Otto's notebook as an example of extra-cranial cognition; it having the same memory-recall capacity for Otto that Inga's internal memory has for her.

A&A's necessary conditions for the cognitive

To dismantle the arguments provided by defenders of EMH in general, and Clark and Chalmers in particular, A&A set out to find the bounds of cognition by finding the difference between the cognitive and the non-cognitive and thus uncovering what they call "the *mark of cognition*". They agree with defenders of EMH that spatial location (just being inside the brain) clearly cannot be the mark of the

[4] Andy Clark, *Coupling, Constitution and the Cognitive Kind: A Reply to Adam and Aizawa,* p. 3
[5] Clark and Chalmers, *The Extended Mind*

cognitive. Thus they provide rules, two necessary conditions, which according to them will determine what can be classified as cognitive versus that which can be dismissed as non-cognitive.

The first necessary condition A&A impose on the cognitive is for it to involve intrinsic content. Supported by Fodor and Dretsky's conception of mental representations and relying on *"a fairly broad consensus"*[6] that cognition involves representations, they comfortably presuppose that cognition must involve intrinsic content. They believe that any representation that has been socially or culturally determined, such as language or symbol conventions cannot be cognitive because it has derived content. However they do not exclude the appearance of non-intrinsic context in a cognitive process.

The second necessary condition states that cognition is constituted by specific causal processes. To arm their argument A&A provide a series of examples which attempt to *"carve nature at its joints"*[7], by proposing theories to explain phenomena that are based on a lack of true understanding of the process at hand. The authors claim that the cognitive might *appear* to be like other natural domains, but the difference lies in the causal process. In the Turing test, a computer might output intelligent human-like responses, but the software's *look-up* process for those responses does not, according to A&A, resemble the process that a normal cognitive agent would undergo. Similarly, with digital chess playing; a computer program goes through millions of possible moves before taking action, while a human chess grandmaster has been found to only work through a very limited set of possibilities. Therefore, they claim, the *process* is completely different and as such, under their rule, dismissible.

Armed with the two necessary conditions they impose for the cognitive, A&A dismantle most examples provided by supporters of the external mind theory. With the Tetris example they believe there is a "*principled difference*"[8] between the three cases in regards to their two necessary conditions. First, they claim that in the button-pressing case, the Tetris blocks are not representations of blocks, they *are* the blocks. Second, they point to the differences in the causal processes; pressing a button to rotate the block involves producing a change in the phosphorescent screen, which is not the same process that occurs in the brain.

Similarly, in the Inga-Otto example where C&C use Otto's notebook as an example of extra-cranial cognition, A&A test it against their two necessary conditions to find it does not fulfill either.

[6] Fred Adams &Ken Aizawa, *The Bounds of Cognition*, p.48
[7] Ibid., p.51
[8] Ibid., p.54

First, Otto's use of the notebook to find MOMA's location involves the use of symbols on a page which are representations with *merely derived content*. Second, the process of memory recall differs; Inga uses a part of her brain capacity that Otto has lost, his memory recall relies on cognitive-motor-visual process of taking the notebook out, turning to the right page and reading the information. Thus in the light of their necessary conditions, the authors confidently dismiss this second example.

1.2 Flawed assumptions

As we began to intuit in earlier examples, A&A often provide questionable assumptions to support their rejection of the EMH. Here we will explore how these imposed rules are, in effect, heavily flawed and reliant on a misconstrued conception of the arguments that support the extended mind. As such these flaws, which have been grouped in the following three themes, cannot serve as determinants for the mark of cognition.

First Flaw: incorrect parts-to-whole relation

While not as clear in the earlier paper, in their follow-up essay *Defending the Bounds of Cognition* where A&A respond to Clark's critiques, they stress that this first necessary rule applies only to processes that involve *no* intrinsic content[9]. Therefore by their own admission, cognition can have derived content as long as there is also some intrinsic content. So when they dismiss the Otto-Inga example because Otto's notebook has derived content in the form of letters on a page, etc, they are dismissing a putative part of the cognitive system that by itself does not have any cognitive capacity; the book on its own, not being used, is not part of the cognitive system[10]. It is at the moment of retrieval and use where Otto+notebook form a cognitive whole that is not reducible to its parts. It is this whole that needs to be tested against their rules. And given that Otto+notebook form a hybrid whole involving both derived and intrinsic content (Otto himself having intrinsic content), it fits into the first necessary condition.

Latent in the weakness of their first rule for cognition is a deeper flaw A&A commit; they apply fixed categories to parts and wholes of a cognitive system. In other words, they assume that the function of component parts that make up a whole cognitive system are fixed by how they *sometimes* function. So in the case of Otto and his notebook forming a cognitive system, A&A assume that the

[9] Fred Adams &Ken Aizawa, *Defending the Bounds of Cognition* , p. 5

[10] Indeed neither C&C nor any extended mind theorist would suggest it does. More on this point further in the paper.

notebook is always part of the cognitive system. But Clark makes it clear that it is important to look at *timing*.[11] In the Otto-Inga case, the notebook is part of the cogitative system at the particular time of retrieval and use. It is not part of the cognitive system all of the time, only at a particular instance when it is coupled with the cognitive agent; when Otto opens it to the right page and looks up the information he is seeking. We will come back to this part-to-whole flaw when discussing the theory of assemblages.

Second Flaw: homogeneity of brain-bound processes

In the second condition A&A provide to determine the mark of the cognitive there is also a questionable assumption, namely that brain-bound processes are similar from agent to agent. Clearly this cannot be the case; not only is the physical *wiring* of neural connections different from person to person but also the way people process information mentally is different. To illustrate this we can take the case of two people having to compute a simple string of additions mentally: 23+ 4+ 7+ 6. Each person will most likely undergo different processes to find the same result; one might proceed by simply adding the numbers in a linear fashion starting from left to right 23 +4=27, 27+7=34, 34+6=40, while another might find it easier to see patterns such as 6+4 =10, 23+ 7= 30, and then add 10+30=40. The brain-bound process each person undergoes in this example is completely different.

Throughout the paper, A&A constantly refer to what is known about the brain to support their arguments, with statements such as: *"tradition has it that processes inside the brain are unlike the processes found outside of the brain",* even if by their own admission we know very little about cognitive processes. Yet, as shown with the above example, it is an empirical fact that brain-bound processes which produce the same cognitive outcome are not the same. A&A not only choose to ignore this fact, but also build a necessary rule for the cognitive around this flawed assumption.

Third flaw: fallacious claim about EMH

A&A place most of the examples given by C&C under the umbrella of the *coupling argument* which they frame as "*coupling-constitution fallacy*"[12]; the most common mistake they charge extended mind theorists with. As with the examples we have seen provided by C&C, when a cognitive human agent is linked in a two-way interaction with a non-cognitive agent, this creates a tightly coupled system that

[11] Andy Clark. Coupling, Constitution and the Cognitive Kind: A Reply to Adam and Aizawa , p 12

[12] as can be seen in detail in their paper of the same name: Adams & Aizawa, *Coupling-Constituion Fallacy Revisited* (2010)

according to Clark *"can be seen as a cognitive system in its own right"*[13]. A&A differentiate coupling relations from constitutive relations, and insist that interaction with the environment, even a two way interaction, does not equal extension.

By charging the defenders of EMH with the *coupling-constitution fallacy* A&A are in effect attributing them with a fallacious claim. This is made quite explicit by Adams and Maher with what they put forth as the schematic of the misconstrued claim: "*if X is coupled to Y then X is part of Y*" [14]
By stating that the notebook (X) is tightly coupled with Otto (Y) order to produce a cognitive outcome, Clark and Chalmers are not saying that the notebook becomes a part of Otto. Rather that the *assemblage* of Otto+notebook form a new tightly coupled *emergent*[15] cognitive system.

Ina a parallel assumption, A&A are critical with what they see as a flawed *behaviorist* conception of cognition, which they say radical theorists rely on, whereby anything that produces the same behavior as a cognitive system must in itself *be* a cognitive system. In their view this conception relies on making the following deduction:
*If behavior B is produced by cognitive process G, and behavior B is also produced by another process G*FF32, then G*FF32 is a cognitive process*
What A&A seem to say with their coupling constitution fallacy is that EMH supporters also claim that in being coupled with a cognitive process, the component *FF32 becomes cognitive in its own right. But this is clearly not what supporters of EMH are suggesting.

1.3 On extended consciousness

In a forthcoming essay "*Consciousness: Don't Give up on the Brain"* A&A tackle the even more controversial claim that consciousness is also not limited to the confined of the brain, but involves the entire organism and even the environment. In line with their *intracrainalism* about the cognitive, A&A are equally adamant about intracranialism with regards to consciousness. Their paper is dedicated to critiquing Alva Noë, who is one of the most vocal supporters of extended consciousness.

[13] Quoting clark, Fred Adams &Ken Aizawa, *The Bounds of Cognition,* p56
[14] Adams and Maher, *Giving a Damn*. They introduce the idea of functional equivalence to provide a more accurate account of what EMH really claims: "*If X (external item) is functionally equivalent to Y (inner item), which is already acknowledged to be a component in Z (a cognitive system), then the cognitive status accorded to Y should equally well be accorded to X*".
[15] Emergence can be illustrated with the example of patterns in cellular automata, which are often considered the paradigm example of emergence in recent complex systems theory. From a the repetition of a simple rule, unexpected complex high-level patterns *emerge*. In this paper we will use the notion of something being *emergent* if it cannot be explained by looking at its component parts.

In a series of publications and lectures Alva Noe puts forth his theory of consciousness (and perception) that asserts it is not only the neurons in the brain that enable consciousness, but rather the assemblage of brain, body and environment. He claims that there is an ecological correlate of consciousness, and an interdependence of perception and action rather than by a passive vision approach. Noe suggests that consciousness is not something that happens inside us, it is something we *do*.

"*Consciousness requires the joint operation of brain, body, and world"*[16]

A&A believe that Noe typically wants to claim that action is necessary for perception, and indeed constitutive of it. So they ask, "if action is necessary for perception, then one needs the brain apparatus for action, right?"[17] Indeed, as admitted by Noe himself we need the brain as part of a coupled system with the environment and body for consciousness to emerge[18].

A&A rebuke Noë 's various *enactivist* positions (which they classify as weak and strong encativism) by challenging the idea that action is necessary for consciousness. However, delving into the specifics of the arguments for and against enactivist theory go beyond the intentions of this paper. Suffice it to say, we believe A&A commit similar fallacious assumptions and suppositions in criticizing Noë for his extended consciousness hypothesis as they do when attacking Clark and Chalmers' arguments for the extended mind hypothesis.

[16] A. Noë, *Out of Our Heads*, o*p. cit.*, 10

[17] This quote and a compelling discussion regarding consciousness can be found in: http://philosophyandpsychology.com, under the heading "*Defending Alva Noë against Jesse Prinz*"

[18] Interestingly, David Chalmers in his distinction between weak and strong emergence, claims that consciousness is an example of strong emergence. For him, this is highly controversial because it cannot be explained with the current models of science, and claims that our conception of nature needs to be expanded to accommodate this notion of strong emergence; "*there is reason to believe that the facts about consciousness are not deducible from any number of physical facts"*

MIND AS AN ASSEMBLAGE

2.1 Theory of Assemblages

In the light of the controversial and radical critiques of extended mind and extended consciousness that we have seen, we would like to explore a possible new model for the mind (that could be extended to consciousness) which is consistent with the EMH but provides a breakage from the critiques put forth by intracranialist like A&A. This new model requires looking at the theory of assemblages as first put forth by Gilles Deleuze, and further developed by Manuel DeLanda.

What Deleuze calls *assemblages*[19] are wholes characterized by *relations of exteriority*. These relations imply that the component parts of the whole - of the assemblage- may be detached from it and plugged into a different assemblage in which the interactions are different. Thus the component parts of an assemblage are self-subsistent and have a certain autonomy to form relations that can change. In other words, relations of exteriority imply that the properties of the component parts can never explain the relations which constitute the whole.

Another important characteristic of assemblages is the heterogeneity of the component parts. In Deleuze's words:

> *"What is an assemblage? It is a multiplicity which is made up of many heterogeneous terms and which establishes liasions, relations between them, across ages, sexes and reigns--different natures. Thus, the assemblage's only unity is that of co-functioning"*[20]

In the Otto-Inga scenario, at the moment of retrieval and use Otto's notebook is part of a cognitive assemblage, or what C&C call a tightly coupled system, whereby the relation that ties Otto and notebook is contingent, not necessary. So when the notebook goes bag into Otto's bag, for instance, it becomes part of a different assemblage, say '*bag-assemblage'* that will include the notebook and the other items Otto might have in the bag, it is no longer part of the original cognitive assemblage. The reason why the whole cannot be reduced to its parts is because the properties of the whole are not made up of the aggregation of properties of its parts. Rather, the whole *emerges* from

[19] Here we will be supported by Manuel DeLanda's broader understanding of assemblages, that allows to consider entities (such as species and biological organisms) that Deleuze would consider too homogeneous, and introduces other terms (strata) to deal with them.
[20] Deleuze and Parnet, *Dialogues II,* p. 69

exercising the *capacity* of each part, and this capacity, while dependent on its properties, is not reducible to them. In other words, the mind as an assemblage means that relations between components of the mind are only contingent, not constitutive.

To clarify the distinction between a *property* and a *capacity*, we can look at the example of a knife.[21] A knife has a series of listable properties, such as being sharp, shiny, heavy etc, which are fairly easy to describe. On the other hand, the knife also has capacities that need to be exercised in order to become *actualized*. So the capacity a knife has to cut things only becomes actualized when it enters into relation with another body, say a loaf of bread, which in turn has the capacity of being cut. And there is an open-ended amount of possibilities for that knife to exercise that capacity[22]; it is not finite like is properties. Thus, capacities are always relational and imply a coupled system: the capacity to affect (cut) must always be coupled with a capacity to be affected (being cut). In other words, a property is a *state* that is characterized by finite relations of interiority; whereas a capacity is an *event* that implies interaction between agents characterized by relations of exteriority.

2.2 Mind as an assemblage

To expose why the theory of assemblages is relevant to the debate around the extended mind, it will be important to contrast it with the flaws we have identified A&A making in their attack of the EMH.

For A&A the mind is a whole that constitutes a seamless *totality*. The components of the whole (the parts that make cognition possible) are constituted by relations they have with other parts of the whole: they are based on *relations of interiority*. In this conception there is a strict reciprocal determination between parts. This is the root of the fallacious assumptions A&A make in accusing extended mind theorists of "coupling-constitution fallacy". They mistakenly charge supporters of EMH with saying that a coupled system constitutes a seamless whole, where the parts are constitutive of each other (*if X is coupled with Y then X is part of Y*). But as we have seen this is not what extended mind theorists are claiming. On the contrary, what they are claiming is consistent with the idea of a coupled system being an *assemblage* not a totality: it is a new emergent whole which cannot be reduced to the sum of its parts. In the same way that brain-bound cognition cannot be reduced to the

[21] Manuel DeLanda provides this example in "*Material Evolvability and Variability"*
[22] This ties into Alva Noe's conception of extended consciousness as involving *action*

sum of all the different neural connections, the properties of the coupled system Otto+notebook cannot be reduced to the addition of the properties of the notebook and the properties of Otto.

A&A claim that extended mind supporters have not yet provided a "*plausible theory of what distinguishes the cognitive from the non-cognitive".*[23] Clark's response to this, which ties in well with assemblage theory, is that in the first place it makes no sense to determine whether something is or not cognitive *"when applied to some putative part of a cognitive agent or of a cognitive system"*; and second, he clarifies that the appeal to coupling is not intended to make any external object cognitive *"Rather, it is intended to make some object, that in and of itself is not usefully (…) thought of as either cognitive or non-cognitive, into a proper part of some cognitive routine."* [24]

In light of the terms provided by assemblage theory, it seems that A&A believe that cognition is a *state*, describable through relations of interiority, or, what is the same, they conceive of cognition as a whole with properties that can be reduced to the properties of its parts. Furthermore they assume that the way these parts function *sometimes*, determines how they function *all* of the time, thus committing a fallacy themselves[25]. A&A work within a world of fixed and definite categories, which is hardly consistent with the complexity of cognition.

On the other hand the *mind-as-an-assemblage model,* which we believe runs parallel to the EMH, envisions cognition as an *event* with infinite possibilities of interaction. Under this view cognition is a *capacity*, and as such is relational: it can affect and be affected by something external to itself. We believe that the *mind-as-an-assemblage model* provides a way of understanding the complexity of the whole mind without reducing it to its micro-level parts.

2.3 Social Assemblages

Assemblages are *emergent* entities that have the potential to combine with others to produce even larger assemblages. Both assemblages, and their component parts, are thus characterized by reciprocal relations of exteriority. For an entity to be an assemblage it must have properties that are not reducible to its parts and those properties must have an explanation in terms of the interaction of its part. Society can be conceived as one such assemblage.

[23] *Defending the Bounds of Cognition*, p.17
[24] *Coupling, Constitution and the Cognitive Kind: A Reply to Adam and Aizawa* p. 5
[25] Adams and Maher, call this "*functional-fixedness fallacy"*

In a similar way to how neurons and their dynamics of interaction are a bit of a mystery to us (we don't have much insight into the mechanisms that make cognition possible), the interaction of social entities (persons, communities, cities,…) are also a bit of a mystery. These entities have *emergent* properties-properties that cannot be explained by just looking at the entities themselves. In this model social entities exist independently of the content of our thoughts; they have a *being* but we can be wrong about the nature and the process that make up that being. And even though individuals are an important component within a society, the society has emergent properties that cannot be explained by merely looking at the individuals that are part of it.

In the model of assemblages, language is a component part of a social assemblage, but it does not play a constituent role in social assemblages, it is simply one amongst several primary expressive modes. There are also important non-linguistic practices that make up society, as well as of course non-human elements that also shape society (viruses, bacteria, weeds or non-organic energy and material flows like wind and ocean currents). In this model language itself becomes just another component part of a much larger system.

CONCLUSION

3.1 Cognition and the search for a totalizing theory

Throughout their papers A&A exhibit a clear preoccupation with coming up with unvarying, static, rules to define and provide a framework for a future cognitive science. Their concern stems from fixed idea of what science is and how cognitive science has to fit within existing models. For them "*transcranial processes are not likely to give rise to interesting scientific regularities"*, whereas intracranial processes, such as human memory, human perception and human thought, exhibit law-like regularities that are classifiable within a given framework.

A&A are concerned that humans coupled with tools to aid memory, perception or thought will be engaged with systems of such huge range and diversity that they don't believe it will be possible to find law-like regularities that govern each of these external systems, or the brain coupled with these external systems. A&A are determined to prove that their "*common sense view*" is the only option for cognitive science to evolve into a "*mature science"* resembling physics, chemistry or biology. Indeed they hypothesize that if cognition as held by *supporters of radical tool use* (C_R) were to exist it would never turn out to be a *natural* science; whereas their *common sense* view of cognition (C_{CS}) would.

Adams and Aizawa emphasize, and often repeat, that their claim about cognitive processes all happening within the confines of the brain is "*a matter of contingent empirical fact".* They believe that there is enough known about psychological and physical processes to rule out the extended mind theory. They are attempting to fit cognition and cognitive science into a universal framework with fixed categories. They seem obsessed with positioning everything in relation to what is already known ("matter of contingent empirical fact"). This view will invariably make us fall back onto outmoded models that cannot provide a way forward. The theory of assemblages, particularly as developed by DeLanda[26] provides a way forward.

[26] DeLanda doesn't introduce other terminology to explain the assemblage-quality of smaller entities as does Deleuze does, he allows assemblage theory to encompass those smaller instances of assemblage behavior

3.2 Objections to mind as an assemblage

An objection to the thesis of this paper could be to state that we have not properly identified if purely internal brain-bound cognition exhibit the characteristics of assemblages that we are using to formulate a new model of the mind. This view would therefore require proving that internal cognition is: characterized by relations of exteriority, made up of heterogeneous parts, forms and emergent whole, etc., and only if it complies could we justifiably use the assemblage model for the extended mind.

While we have touched upon these items in the earlier discussion of A&A's flaws, to do this exhaustively would prove to be virtually impossible with the tools at our disposal. However, there is a study which might point a way towards achieving this level of rigor: connectionism and neural network theory. [27]

3.3 Cognition and connections

The central principle of connectionism is that mental phenomena can be described as emergent processes of interconnected networks made up of simple units. Neural network are the most common model used to illustrate this, and they give us an insight into that mysterious *process* that A&A used to dismantle the possibility of extended cognition. They also fit quite nicely into the theory of assemblages.

In this model, biological neural networks are made up of real biological neurons that are connected or functionally related in a nervous system. In the field of neuroscience, they are often identified as groups of neurons that perform a specific physiological function in laboratory analysis. Neural nets have three characteristics: first, they are simple units, capable of calculating their own intensity of activation (and as DeLanda points out, this intensity is what links us to the material world); second, they have a set of changeable connections; and third, they are taught by example and thus learn by *doing*.

Neural nets can be taught to recognize the patterns (intensities) in say a photograph, which is just a series of pixels on a sheet. But they can be taught, by example, to recognize the patterns as a being a particular photo with a particular significance. Similarly, neural networks are trained to

[27] What follows on connectionism and neural networks is taken in large part from a lecture given by DeLanda at the European Graduate School: "Symbols and Connections", 2011

recognize patterns that form a face. But they don't do this by recognizing the face itself, rather by recognizing the pattern of connections that form the representation of the face, and they store (in their memory) the means to reproduce those patterns, not the patterns themselves.

Without getting too deeply into the details of this fairly complex and mathematically sophisticated matter, what we would like to emphasize is what connectionism and neural network models tell us about memory storage. What they make clear is that memory is stored in the connections; we do not store representations in our heads, we store the means to reproduce those representations. In other words, this cognitive process lies in the connections between the component parts, not in the parts themselves.

Conclusion

This paper sets out to question the foundations on which the critique to the extended mind is built, mainly by identifying the flawed assumptions made by Adams and Aizawa, the most vocal opponents of the theory. It also sets out, not to uncover the mark of the cognitive, if such a thing is even possible, but rather to explore a different model for the mind that does not try to find totalizing rules and fixed frameworks, but rather point a way forward in the debate around the extended mind and extended consciousness. This new model, as we have seen, has been provided by the theory of assemblages .

The new model of *cognition as an assemblage* is consistent with the extended mind hypothesis, but eliminates the need to deal with flawed assumptions such as those made by A&A. In this model, the mind emerges from components characterized by *relations of exteriority;* where the whole is *emergent* and as such cannot be explained by looking at its component parts. Assemblage theory, in conjunction with connectionism and neural network theory, has helped us conclude that what is important in a new conception of the mind is the connections between the parts, not the parts themselves.

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