# The coupling-constitution fallacy

## Much ado about nothing

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The coupling-constitution fallacy claims that arguments for extended cognition involve the inference of "x and y constitute z" from "x is coupled to y" and that such inferences are fallacious. We argue that the coupling-constitution fallacy fails in its goal to undermine the hypothesis of extended cognition: appeal to the coupling-constitution fallacy to rule out possible empirical counterexamples to intracranialism is fallacious. We demonstrate that appeals to coupling-constitution worries are problematic by constructing the fallacious argument against the hypothesis of extended cognition. We consider several objections to our argument and find them insufficient to rebut our conclusion.

**Keywords:** Coupling-constitution fallacy, extended cognition, intracranialism

> *Prof. Hobbes: For the last time! Nothing can live on the surface of Midnight!*
> *The Doctor: Professor, I'm glad you've got an absolute definition of life in the Universe, but perhaps the Universe has got ideas of its own, hm?*
>
> *Doctor Who, "Midnight"*

## 1. Introduction

Professor Hobbes was concerned with showing that there was no life on the planet Midnight; Adams and Aizawa (2001, 2008, 2009, 2010; Aizawa 2011; Adams 2011) are concerned to show that there are no transcranial cognitive systems. And while the universe may have ideas of its own with respect to what counts as living, Nature may have its own ideas with respect to what counts as a cognitive system.

Of course, Adams and Aizawa (unlike Professor Hobbes) do not claim to give an absolute definition of what can be a realizer of cognitive processes. They argue that the hypothesis of extended cognition (hereafter: HEC) is wrong as a matter of empirical fact. Among their arguments, the coupling-constitution fallacy has

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gotten a lot of mileage in the extended cognition literature. The coupling-constitution fallacy is the purportedly fallacious inference that coupling relations entail constitution relations. They suggest that the most common strategy to argue for extended cognition, which involves sliding from coupling relations to constitution relations, is illegitimate. Adams and Aizawa base their argument on what we call the 'Coupling-Constitution Inadequacy Claim' (hereafter: CCI), which claims that coupling does not guarantee constitution.[1] In what follows, we argue that the CCI is an empirical generalization and its use in arguing against transcranial realizers of cognitive processes is question-begging. Other philosophers – Clark and Chalmers (1998), Clark (1997, 2008), Menary (2007a, b), Hurley (2010), and Ross and Ladyman (2010) – have made similar suggestions; but, in believing that the best way to show that the argument against HEC relying on the CCI is question–begging, we construct the question–begging argument.

## 2.. Coupling, constitution, and HEC

In this section, we introduce our understanding of Adams's and Aizawa's influential critique of the HEC and their basic worry – the potentially illicit inference of constitutive relations from coupling relations. We then present their objection as claiming that coupling relations do not guarantee constitution relations, though they can hold of the same elements at the same time.

HEC holds that realizers of cognitive processes are distributed across brain, body and world. What makes an extracranial element a part of the cognitive process itself, and not simply a causal or influential factor, depends on its relationship to the individual. Broadly speaking, realizers of cognitive processes constitute a cognitive system when those realizers are causally coupled. In cases of distributed cognitive systems, the mutual causal influence of x and y cannot be teased apart; dense, tangled lines of causal influence bind the parts of the system together. Different philosophers propose different taxonomies for classifying brain-body-world cognitive units (cf. Clark and Wilson 2008; Sutton 2006), though they typically share a commitment to relying on establishing constitution by way of thoroughgoing causal coupling.[2]

Clark and Chalmers's (1998) example of Otto and Inga, ubiquitous in discussions of HEC, illustrates how agents couple with externally located objects to created extended cognitive systems. Otto and Inga both decide to go to MoMA. Biotypical Inga recalls the location of MoMA and heads off towards 53rd Street. Otto, an Alzheimer's sufferer, consults his notebook for the address of MoMA and heads towards 53rd Street. By hypothesis, Otto is coupled to his notebook, depending on it for some tasks as much as Inga relies on her biological memory.

According to the HEC, Otto's notebook and the relevant bits of Inga's brain play the same type of role in their respective cognitive systems. What makes Otto's notebook part of Otto's cognitive system is that he is coupled to it: just as parts of Inga are coupled to parts of her nervous system that are relevant for memory, Otto is coupled with his notebook.

Even though most HEC-enthusiasts agree that agents couple with external elements, the substance of that coupling relationship has yet to be spelled out to widespread agreement. Differences typically come out in taxonomies of extended cognitive systems. Wilson and Clark (2009) suggest that external resources may be either (1) natural, (2) technological, or (3) sociocultural. They also suggest that extended cognitive systems can be transient – assembling for one-off purposes – or for recurring purposes. Long-term extended cognitive systems for Wilson and Clark rely on permanent features of the environment; transient ones rely on soft-assembled systems whose parts are needed only for a short time.

Sutton (2006) offers a taxonomy of resources drawn on in extended cognitive activity, including symbol systems, natural resources, embodied habits and capacities, and internalized cognitive artifacts. Sutton, like Wilson and Clark, distinguishes degrees of diachronic variation. Sutton (as well as Menary 2007b) cashes out coupling in terms of "more-or-less tight, more-or-less durable" complementary elements.

Adams (2010) usefully distinguishes between two kinds of coupling arguments for HEC. One kind of argument identifies what we might call "single-causal loops". The case of Otto as described above might be a single-causal loop case of extended cognition: we trace single loops between internal and external processes. Another kind of argument identifies what we can call "multiple-causal loops". Noë (2004) and the papers collected in van Gelder and Port (1995) appeal to dense collections of causal lines between internal and external resources to defend distributed cognition. Though HEC theorists might diverge on the details of what constitutes coupling, this much seems clear: coupling plays some important role in describing extended cognitive systems.[3]

Now the coupling-constitution fallacy claims that arguments for the HEC infer constitution relations from coupling relations. Adams (2010: 333) writes:

> Once one sees that a causal connection between a process of type X and a process of type Y is not enough to convert the Y process, or even the conjoined X-Y process, into a process of just type X, then one can also see that essentially the same point applies even when there is a reliable causal connection between X and Y. One might also see that essentially the same point applies when there is a reciprocal causal loop in which an X process causally influences a Y process that in turn influences the X process.

Clearly, however, no HEC theorist would agree to this description. In describing extended cognition in this way, Adams tacitly supposes that cognition is something inside the head that bleeds out into the world. But cognitive processes are not like mental missionaries, going out into the world converting non-cognitive processes into cognitive ones, and no HEC theorist would (or should) describe extended cognition in that way. A much more plausible version of the coupling-constitution fallacy is: the fallacious slide from 'x is coupled to y' to 'x and y constitute z'. But more important is Adams's and Aizawa's (2001, 2008, 2009, 2010; Adams 2010; Aizawa 2010) insistence that coupling relations are insufficient for grounding constitution relations. They write, for example:

> One cannot simply move from an observation of a causal dependency between cognition and the body and the environment to the conclusion that cognition extends into the body and environment (Adams and Aizawa 2008: 91).
> ...there is a kind of inattention [in the HEC literature] to the difference between causal dependencies and constitutive dependencies (Adams and Aizawa 2008: 89)
> ...the fact that object or process X is coupled to object or process Y does not entail that X is part of Y (Adams and Aizawa 2010: 68)

The coupling-constitution fallacy claims to identify the fallacious inference of "x and y constitute z" from "x couples with y". The principle underwriting the coupling-constitution fallacy is what we are calling the 'Coupling-Constitution Inadequacy Claim' (CCI). CCI says that constitution relations do not hold of two elements in virtue of being coupled, though these relations may hold of the same elements simultaneously. The CCI is a putatively accurate picture about the nature of constitutive relations: permitting coupling relations to ground constitution relations is ontologically dubious. The CCI allows one to assert instances of the coupling-constitution fallacy as fallacious.[4]

To motivate the difference between coupling and constitution relations, Adams and Aizawa (2008; Adams 2010) appeal to thermostats. The bimetallic strip in a thermostat is coupled with the ambient air: Changes in the curvature of the strip cause changes in the ambient air temperature by work of the heating system, and changes in the ambient air temperature cause changes in the curvature of the bimetallic strip. Even though the bimetallic strip and the ambient air are coupled, they do not, according to Adams and Aizawa, constitute anything. Consequently, coupling relations are obviously distinct from constitution relations and instances of the former do not guarantee instances of the latter. (In section 3, we discuss why we are unconvinced of the conclusion drawn from Adams's and Aizawa's characterization of the thermostat.)

In general and (hopefully) noncontroversial terms, we take "constitution" in debates in HEC to pick out a relation in which some element, along with others,

makes up some larger whole. When we say that "x is a constitutive part of Z" or "x and y constitute Z" we mean that x is part of what makes Z the thing that it is and that x and y make Z the thing that it is. What we have in mind by "constitution" is exemplified in common examples like: legs and a top constitute a table; batteries partly constitute mobile phones; pages partly constitute books; lenses are parts of glasses; bristles and handles constitute toothbrushes; collars partly constitute shirts; etc. These examples illustrate what we take to be the commonsense notion of constitution at work in debates over HEC, and importantly illustrates constitution relations fleshed out without appeal to coupling: whatever is the final philosophical account for why the table's legs and top constitute the table, there is no compelling need to appeal to any causal coupling relations. More formally:

> CCI: if (i) element s1 couples with s2, (ii) s1 and s2 constitute a mechanism M, and (iii) M realizes cognitive process P, then s1 and s2 do not constitute M in virtue of their being coupled.

Again, it could be that s1 and s2 constitute M, but their being coupled has absolutely nothing to do with it.

Conditions (i) and (ii) in the formal version have already been discussed. Now consider (iii), which explicitly includes mention of realization of cognitive processes. By our lights, the CCI does not stand or fall with different accounts of realization; but we present here Putnam's (1970) account. To say that a cognitive processes P is realized in M means: P is a higher-order type quantifying over lower-order types whose tokens are concrete states.

More important is the relationship between the higher-order type and the elements constituting the lower-order, realizing token. The token of the lower-order type realizes the higher-order type; the elements constituting the lower-order token do not realize the higher-order type. Aesthetic properties illustrate this: suppose Beethoven's "Moonlight Sonata" realizes an aesthetic property, like beauty. Intuitively, it is not a single note or measure of music that realizes that property; individual notes in "Moonlight Sonata" do not realize the property of beauty. It's the work as a whole (or some suitable section of the work) that realizes that property. Similarly, individual neurons do not realize cognitive properties; there are no grandmother neurons. Rather, it is some system – neural systems according to Adams and Aizawa, brain-body-environment systems according to HEC theorists – that realizes cognitive properties.

There are two features of the CCI that make it especially powerful against the sort of coupling considerations advanced by HEC theorists. First, the CCI says that coupling does not turn some set of elements into constituters of M; coupling, according to the CCI, plays no role in making some collection of elements a unified whole. This is weaker than the claim that coupling relations are insufficient for an

account of the constitution of realizers of cognitive processes: if coupling relations are insufficient for constitution relations, then (by our lights) it sounds as though coupling relations plus something else will be involved in the final account of the constitution of realizers of cognitive processes. If coupling relations are insufficient, that leaves open that coupling plus (for example) the admission of truth-value gaps in propositions about realizers of cognitive processes could be the final account of constitution relations (cf. Lewis 1982; Fine 1975). Or that coupling plus being taken up in the life of an organism could be the final account of constitution relations (cf. van Inwagen 1990). The CCI, by contrast, admits that causal coupling may hold among realizers of cognitive processes, but causal coupling doesn't make a lick of difference to whether those realizers constitute anything.[5]

Second, the CCI does not rule out the constitution of neural systems from smaller subsystems. The CCI can grant that the fusiform gyrus and the amygdala are both part of the neural system responsible for recognizing other individuals, but what does the explanatory work for why those two parts constitute a recognition system is waves of excitation of neurons constituting the fusiform gyrus and amygdala. It might be helpful to know that they are causally coupled, but it's the waves of excitation that accounts for their constituting a single neural system.

We have presented CCI as indifferent to coupling as the ground of constitution relations. A point we mention now, but return to in section 4, eases up on this claim: maybe coupling could play some role in constituting realizers of cognitive processes. This would be open to the advocate of the CCI provided she supplemented it with some grounds by which to distinguish coupled systems that are cognitive from coupled systems that are not.

## 3. Identifying the question–begging argument

We have argued in section 2 that the CCI is in a claim about the nature of cognitive systems that make instances of coupling-constitution reasoning fallacious. But now consider reasons for endorsing the CCI. It is justifiable either a priori or a posteriori. And it is far from clear that CCI is justifiable a priori. Adams and Aizawa (2010) write that coupling relations are distinct from constitution relations; therefore, the former do not entail the latter. But, this is a non sequitur: if property P1 is distinct from property P2, it does not follow that 'being P1' fails to nomologically or logically entail 'being P2.' For example, 'being a renate' is distinct from 'being a chordate' but that itself does not bar 'being a renate' from nomologically entailing 'being a chordate'. Similar comments hold for the distinction between 'being square' and 'being quadrilateral': even though being square and being quadrilateral are two distinct concepts, their distinctness does not stop

'being square' from logically entailing 'being quadrilateral'. The distinctness of two properties does not, of itself, prohibit the entailment of one by the other.

Obviously then, the CCI is justifiable a posteriori. It claims, as mentioned above, that for all s1...sn, M, and P: if s1...sn are coupled mechanisms that constitute M and M realizes cognitive process P, then s1...sn do not constitute M in virtue of being coupled. Note that quantifier "all" ranges over natural cognitive systems: Adams and Aizawa (2001: 46) argue that "as a matter of boring contingent empirical fact" cognition is intracranial.

Using the CCI to rule out a priori any transcranial mechanisms realizing cognitive processes is to beg the question against examples in support of the HEC. To see this, consider, again, Otto and Inga. According to the HEC, what makes Otto's notebook part of Otto's cognitive system is that he is coupled to it. An argument relying on the CCI concluding that the relevant portions of Otto and his notebook do not constitute a realizer for cognitive processes might reasonably look like this:

1. If (i) s1...sn are coupled elements, (ii) s1...sn constitute mechanism M, and (iii) M realizes process P, then s1...sn do not constitute M in virtue of being coupled.
2. (i) Otto couples with his notebook, (ii) Otto and his notebook constitute a mechanism M, and (iii) M realizes memory process.
3. Therefore, Otto and his notebook do not constitute M in virtue of being coupled.

This argument against Otto and his notebook constituting a cognitive system is question-begging: in order for the first premise to be true, the conclusion must already be assumed to be true. If the conclusion turns out to be false – if Otto and his 1988: 46–50) notebook do turn out to be a structure realizing some cognitive process in virtue of their being coupled – then the generalization in premise 1 would be falsified. That is, assertions of the first premise, of the CCI, tacitly assume that the conclusion is true, that there is no guarantee of a system constituted by Otto and his notebook.[6] The CCI rules out the possibility of transcranial realizers of cognitive processes by prohibiting coupling relations from grounding constitution relations; but, since the CCI is justifiable by appeal to empirical data, ruling out putative counterexamples by appeal to the CCI begs the question against the existence of extended cognitive systems.

Though our argument is a new contribution to the literature, it resembles an argument given by Chemero (2009: 4-16). There, Chemero is interested to show the prevalence of such "Hegelian arguments" against dynamical cognitive science that rely on conceptual commitments rather than empirical evidence. One of Chemero's examples of a Hegelian argument is Fodor's and Pylyshyn's (1988: 46–60) criticism of connectionist models of thought:

1. Human thought is systematic. That is, abilities come in clusters.
2. Systematicity requires representations with compositional structure.
3. Connectionist networks do not have representations with compositional structure.
4. Therefore, connectionist networks are not good models of human thought (2009: 8).

The argument begs the question on the first and third premises. Regarding the first premise: the evidence cited in favor of systematicity is a chapter from Pinker (1984) which attempts to discredit data showing that thought does not exhibit systematicity. There was no empirical study at the time claiming that thought is systematic, only arguments against data suggesting thought was not systematic. Regarding the third premise: Chemero mentions a number of connectionist (e.g., van Gelder 1990 and Chalmers 1990) who argue that connectionist networks do have representations with compositional structure. So Fodor's and Pylyshyn's third premise rules out a priori connectionist networks with compositional representations.

Nevertheless, our argument is different from Chemero's. Chemero is interested in uncovering oft-found Hegelian arguments against radically embodied cognitive science. Our argument directly aims at showing the error latent in the coupling-constitution fallacy. Chemero and our aims are similar: to ferret out arguments and claims that a priori prohibit non-orthodox accounts. Though our and Chemero's goals are amenable, our arguments and immediate targets are different.

## 4. Objections and replies

As mentioned above, other philosophers have suggested that the CCF? begs the question against the HEC. Adams and Aizawa (2008: 103) say that they do not "presuppose any preferred way of localizing cognitive processes", and that the CCF is a problem even if they "concede a method of localizing cognitive processes to the advocate of extended cognition". Our arguments above show that Adams and Aizawa implicitly presuppose a way of localizing cognitive processes. The CCI underwrites the coupling-constitution fallacy, and the CCI localizes realizers of cognitive processes to inside the head by disallowing coupling relations from grounding constitution relations.

An advocate of the CCI could argue that what distinguishes constituting elements from merely coupled elements is the initial description of the cognitive system plus further empirical evidence found in support of the initial description.[7] What separates those elements that constitute Otto's memory processes from

those that do not is the initial description of the realizers of Otto's memory processes. The initial description does the work of distinguishing constitutive parts from merely coupled elements.

Our response is to grant the objection and let the initial description set what counts as a legitimate part of the realizer of the cognitive process. The resulting problem is that initial descriptions of empirical phenomena can be wrong, and relying on the initial description of some mechanism to rule out alternative accounts is question-begging. Consider early work on the atom. John Dalton argued that the atom is much like a very small billiard ball (cf. Brock 1992: 165–171). Later experiments by Ernest Rutherford strongly suggested that the atom is more like a swirling mass of electrons around a densely packed nucleus (Brock: 1992-473).[8] One can imagine a supporter of the Daltonian model arguing against the Rutherfordian model by adopting the principle "all atoms have a solid structure", appealing to Dalton's description of the atom. Adopting such a principle, the Daltonian might argue that Rutherford's description cannot be right since it violates what is known about atoms namely, that atoms have a billiard-ball-like structure. Consequently, the Daltonian continues, any model of the atom that entails a structure unlike a billiard ball is wrong.

We now know, of course, that Dalton's initial description of the atom is wrong and that Rutherford's is right. Further, our imagined Daltonian's use of the principle 'all atoms have a solid structure' against the Rutherfordian model's interpretation of the data is clearly problematic: using the Daltonian model to rule out alternative models of the data begs the question against the Rutherfordian model.

The advocate of the CCI, in letting the initial description of the realizing system determine what is a part of the system and what is a coupled element, makes the same error as our imagined Daltonian. Initial descriptions can be wrong; and, using initial descriptions to rule out alternative descriptions begs the question. The initial description of realizers of cognitive processes – i.e., that realizers of cognitive processes are intracranial—may be wrong. Using this initial description to rule out models of transcranial realizers of cognitive processes – models in which intracranial elements couple with extracranial elements – begs the question.

Adams' and Aizawa's example of the thermostat illustrates the problem of letting an initial description determine how a system is carved up, consequently ruling out alternative descriptions that are potentially more explanatorily useful. The bimetallic strip and the ambient air temperature, say Adams and Aizawa, are obviously coupled and obviously fail to constitute a larger system. To the contrary, it is useful to think of the thermostat as a dynamical, adaptive device (cf. Ashby 1960). Suppose a room in which the thermostat is set to 68° F (20° C) suddenly receives a blast of cold air – say, from an opened window on a winter's night. This disturbance to the ambient air forces the thermostat–air system to move from its

settled state. When moved out of the settled state, the furnace turns on to bring the air temperature back to where it should be, given the thermostat's setting. The heating system stops its work when the thermostat–air system settles back into a stable state—one where the curvature of the bimetallic strip is neither increasing nor decreasing given the ambient air temperature. The bimetallic strip causally influences the ambient air temperature, and the ambient air temperature causally influences the bimetallic strip. On this analysis, the thermostat and the ambient air are coupled elements, and it is reasonable to regard the thermostat and the ambient air as constituting the air temperature regulation system. So, while it is correct to say that the bimetallic strip and the ambient air are coupled, it is likewise correct (or at least plausible) to say that they constitute a larger system.

An advocate for the CCI might concede that the thermostat example is inconclusive in supporting an obvious distinction between coupling and constitution relations. She may nonetheless argue that our intuitions about the distinction between coupling relations and constitution relations tracks some real distinction: coupled elements in a system really do not underwrite claims to constitution. Even without a fully fleshed out example, she may appeal to overriding intuitions about how to carve nature at its joints. We reply that intuitions in this matter are not reliable. Ashby's (1960) Homeostat reinforces our claim that the distinction between coupled elements and constitutive elements is not as clear as Adams's and Aizawa's analysis of the thermostat would suggest: some causally coupled elements are best understood as constituting a larger system. The Homeostat is a device consisting of four units – called 'uniselectors' – with a pivoted magnetic needle on top of each unit, and an induction coil inside each one. The uniselectors are causally coupled – each uniselector sending signals to, and receiving signals from, every other uniselector. Each uniselector has 25 different starting parameters, so the Homeostat has 390,625 different starting conditions. No matter what starting condition is assigned, the Homeostat, when a current is applied, returns to the same state of the four needles aiming at one point.[9]

While there are a number of salient theoretical points to make about the Homeostat, one is of special interest for us. Each uniselector is obviously coupled to each of the other uniselectors: if we label them 'A', 'B', 'C', and 'D', the behavior of A affects B, C, D; the behavior of B affects A, C, D; etc. And the uniselectors also clearly constitute the Homeostat. It seems obvious (by our lights) to regard the uniselectors as constituting the Homeostat because they are coupled. The Homeostat functions as it does in virtue of its constitutive units; and, the units do what they do in virtue of being coupled. If the uniselectors were not coupled, then the Homeostat would cease to be what it is. We submit the Homeostat as strongly suggesting that CCI-supporting intuitions are faulty.

Ashby's Homeostat and his analysis of the thermostat provide us with reasons to think that Adams' and Aizawa's analysis of how thermostats work is more of an intuition pump, appealing to hunches for carving up elements of causal systems. Just as the uniselectors of the Homeostat are coupled and constitute a larger system (the Homeostat itself), the bimetallic strip and the ambient air are coupled and constitute a larger system in virtue of being coupled.

A third objection, to which we alluded in section 2, begins by granting that coupling alone is insuffcient for constituting elements into a mechanism realizing a cognitive process. But coupling plus something else could be an account of what constitutes mechanisms realizing cognitive processes. A natural candidate for the "something else" is the Mark of the Cognitive (cf. Adams and Aizawa 2008; Adams 2010). Much like Brentano argued that intentionality is the Mark of the Mental, Adams and Aizawa argue that coupling relations and the Mark of the Cognitive establish the constitutive elements of a cognitive system.

Adams (2010: 328-329) proposes the following list as Marks of the Cognitive:

1. Cognitive processes involve states that are semantically evaluable (Dretske 1981, 1987; Fodor 1990).
2. The contents carried by cognitive systems do not depend for their content on other minds (Adams and Aizawa 2001; Adams and Aizawa 2008; Aizawa and Adams 2005; Dretske 1981).
3. Cognitive contents can be false or even empty, and hence are detached from the actual environmental causes (Adams 2003a, 2003b; Adams and Dietrich 2004; Adams and Stecker 1994).
4. [Cognitive systems] cause and explain in virtue of their representational content (Adams 1991; Dretske 1985, 1987).

We think that Adams has provided a serious challenge to the HEC theorist in providing this list of criteria for an element to count as part of a cognitive system, and addressing them fully is outside the scope of this paper. We do, however, want to express two worries about Adams's list.

First, Adams appeals to work by a number of empirically-inclined philosophers. Our worry is that Adams, in devising his list, cherry-picks those things that are nearest and dearest to the hearts of intracranialists. Consider (4), for example. Chemero (2009) and van Gelder and Port (1995) suggest that dynamical systems are not essentially representational but their activities can be described in terms of representations. The cognitive activities are caused by dynamical relations holding between the cognitive agent and her environment but we might explain those activities by appeal to representational contents. Such explanations would involve instrumental appeals to representational contents. So (4) rules out explanations that would appeal to dynamical systems. But whether dynamical explanations turn

out in the long run to provide a better explanation is not something that can be determined by criteria culled from intracranialist accounts of cognitive processes.

Second, if Adams appeals to the empirical data to justify his list of Marks of the Cognitive, we worry that dynamical and radically embodied cognitive science will be ignored or inadequately represented. There is much excellent research being done outside the mainstream of intracranialist cognitive science and to ignore that while putting together a list identifying the Marks of the Cognitive is to identify the intracranialist's Marks of the Cognitive. And though one of us is skeptical about a project of identifying the Marks of the Cognitive,[10] cherry-picking data and explanatory frameworks that unduly favor the intracranialist cannot be tolerated.

## 5. Conclusion

In this paper, we argued that using the CCI to argue against putative examples of transcranial realizers of cognition is to beg the question. We did this by arguing that the CCI is an empirical generalization, and leaning on the CCI to rule out potential counterexamples is question-begging. Further evidence in favor of our position that coupling relations may (and do in some cases) underwrite constitutive relations is found in Ashby's work in the early days of cybernetics research. Consequently, the coupling-constitution fallacy – and its attendent claim of the CCI – is otiose in discussions of HEC.[11]

## Notes

**1.** The following section examines this claim in greater detail.

**2.** This does not hold for all supporters of HEC. Rowlands (2010) explicitly denies this

**3.** Sutton (2006, 2011) and Menary (2007b, 2010), among other 2nd wave HEC theorists, could reasonably be classed as either single-or multiple-causal loop HEC theorists.

**4.** Compare: the gambler's fallacy is an unsound pattern of inference about the likelihood of some future event. What we know about probabilities is an accurate picture about the likelihood of some future event that allows one to identify instances of the fallacy as fallacious.

**5.** As suggested by the above accounts of what constitutes a mechanisms for realizing some cognitive process, we find the philosophical literature on vagueness is more directly relevant to discussions around the coupling-constitution fallacy than the literature on material constitution. See Williamson 1996.

**6.** Consider an analogy. Suppose group X has good empirical evidence supporting the claim that all swans are white. Imagine that group Y comes across a bird that is like a swan in every way

except that it is black. Group Y infers that they have a case of a black swan. Group X, however, claims that it does not count it as a swan because it is black. Group X's argument might look like this:

1. All swans are white
2. Bird B is black
3. Therefore, bird B is not a swan.

This is obviously a question–begging argument. But, the logical structure of the argument against HEC relying on CCI is the same as this question-begging argument.

**7.** Andy Clark (personal communication).

**8.** Rutherford's main target was J.J. Thomson's 'plum pudding model' of the atom: electrons are suspended in a sea of positive charge much like plums in plum pudding. But this historical issue does not detract from the central point of the example.

**9.** See Ashby (1956, 1960) for technical discussion. See Boden (2006: section 4.viii.d) for a non-technical exposition.

**10.** Believing that we just recognize cognitive processes when we see them.

**11.** Thanks to Andy Clark, Richard Moore, and anonymous reviewers for feedback on previous drafts. Authors names are listed in alphabetical order.

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