Causal Essentialism and the Identity of Indiscernibles

Cameron Gibbs

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Abstract Causal essentialists hold that a property essentially bears its causal and nomic relations. Further, as many causal essentialists have noted, the main motivations for causal essentialism also motivate holding that properties are individuated in terms of their causal and nomic relations. This amounts to a kind of identity of indiscernibles thesis; properties that are indiscernible with respect to their causal and nomic relations are identical. This can be compared with the more well-known identity of indiscernibles thesis, according to which particulars that are qualitatively indiscernible are identical. Robert Adams has developed a well-known objection to this thesis by considering a series of possibilities involving nearly qualitatively indiscernible particulars that naturally leads to a possibility involving qualitatively indiscernible particulars. I argue that we can construct parallel cases involving a series of possibilities involving properties that are nearly indiscernible with respect to their causal and nomic relations that naturally lead to possibilities involving properties that are indiscernible with respect to their causal and nomic relations. The same features that make Adams' argument forceful also carry over to my cases, giving us a powerful objection to the causal essentialist identity of indiscernibles thesis.

Keywords Modality · Causal Essentialism · Identity of Indiscernibles · Causal Structuralism

A prominent question in the metaphysics of scientific properties is whether causal and nomic relations between properties are necessary or contingent. Could mass bear lawlike relations differently from how it actually bears them? The causal essentialist answers "no," holding that a property's causal and nomic relations are essential to that property.[1] Massive objects necessarily attract one another.

Many causal essentialists go further in holding that properties are individuated in terms of their causal and nomic relations. This amounts to a kind of identity of indiscernibles thesis: properties that are indiscernible with respect to their causal and nomic relations are identical. Some might object to an identity of indiscernibles thesis by appealing to a modal intuition that distinct, indiscernible entities are possible. However, another kind of objection is based on considering a series of possibilities leading up to distinct, indiscernible entities. These are *continuity arguments*, the most well-known example of which comes from Adams (1979), which I consider below.[2] While some have objected to causal essentialist identity of indiscernibles theses by appealing to the modal intuition that it is possible that there are distinct properties that are indiscernible with respect to their causal and nomic relations, no one has presented a continuity argument.[3] That is what I will consider here. I will construct my own continuity arguments and compare them to Adams' argument, arguing that the same considerations that give Adams' argument force also apply to my arguments. I conclude that this gives us a serious objection to causal essentialist identity of indiscernibles theses. To begin, I briefly discuss identity of indiscernibles theses. In section 2, I argue that the core motivations for causal essentialism also motivate an identity of indiscernibles thesis. In section 3, I consider a causal essentialist identity of indiscernibles thesis, and develop a continuity argument against it. In

[1] Defenders of causal essentialism include, *inter alia*, Bird (2007), Bostock (2003), Ellis (2001), Kistler (2002), Martin (1993), Mumford (2004), Shoemaker (1980) and (1998), Swoyer (1982), and Wilson (2010).
[2] I owe the term 'continuity argument' to Forrest (2016).
[3] Schaffer (2005: 12-13) briefly mentions one, but doesn't develop it.

section 4, I consider a weaker causal essentialist identity of indiscernibles thesis, and develop a continuity argument against that thesis as well.

1 Identity of Indiscernibles

An identity of indiscernibles thesis says that, necessarily, there are no distinct entities indiscernible in a particular respect.[4] Given a general, schematic notion of indiscernibility, call it 'indiscernibility$_s$' we have a schematic version of the identity of indiscernibles:

Schematic Identity of Indiscernibles Necessarily, if x is indiscernible$_s$ from y, then x=y.

We get different identity of indiscernibles theses by restricting the kinds of entities that x and y are and by spelling out the notion of indiscernibility. The most well-known thesis understands indiscernibility in terms of sharing qualitative properties and relations, in a sense that excludes non-qualitative properties such as *being identical with Socrates*, *being the President of the U. S.*, or *being five feet from Aristotle*. While often not explicit, most discussions of this traditional thesis focus only on particulars, and do not consider applying it to properties or other kinds of entities. Call this thesis the *identity of qualitatively indiscernible particulars*.[5]

This thesis rules out the possibility of a world containing only two iron spheres, with no qualitative property or relation distinguishing the two. One might object to the thesis on the basis of the modal intuition that such a world is genuinely possible, as in Black (1952). However, Adams (1979) advances another objection by constructing a *continuity argument*. He has us consider worlds that are much like the world containing only two iron spheres, except there is a slight difference between the spheres that makes them discernible. For example, suppose there is a slight dent in one of the spheres. We can imagine a series of worlds where the dent is made slightly smaller and smaller until we get to a world where the spheres are qualitatively indiscernible. Adams argues that the possibility of worlds with nearly indiscernible

[4] One could also consider identity of indiscernibles theses intended to be merely contingently true, rather than necessarily true, but that lies outside of my interest here.
[5] For more discussion, see Forrest (2016).

spheres pressures us to accept the possibility of a similar world containing indiscernible spheres. His argument is intended to carry force beyond the mere modal intuition that the indiscernible spheres are possible.[6]

The thesis that qualitatively indiscernible particulars are identical is the most well-known identity of indiscernibles thesis, but we often consider theses of this kind for many other entities. For example, the set-theoretic axiom of extensionality states that if sets x and y contain the same members then they are identical. This is an identity of indiscernibles thesis; it says that sets that are indiscernible with respect to their members are identical. There are similar principles for propositions. We can consider whether necessarily co-extensive propositions are identical; in other words, whether propositions that are indiscernible with respect to which possible worlds they are true in are identical.

We can also consider identity of indiscernibles theses for properties. But in what respects are properties discernible from one another? In other words, what features do properties have, in terms of which they are discernible or indiscernible? We can distinguish three broad categories of features. First are structural features, such as being a monadic property or a two-placed relation. Properties also fall into families; for example, the mass properties exhibit a certain sort of structure, whereas the charge properties exhibit a different sort of structure (since there are negative charge properties, but not negative mass properties). These features won't play a prominent role in what follows, for surely many properties are indiscernible from one another with respect to their structural features.

The second feature we can consider is a property's pattern of instantiation. For simplicity, throughout I will only consider instantiated properties. So every property will have a non-trivial pattern of instantiation. Of particular interest is that we can distinguish properties in terms of the spatiotemporal locations of their instances.

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[6] There is a strong case to be made that the identity of qualitatively indiscernible particulars is violated by quantum mechanical phenomena, see French (2015) for details. But regardless of whether we should reject the principle on other grounds, we can still consider how strong Adams' continuity argument is. This is of particular interest for comparing Adams' continuity argument with my own continuity argument against identity of indiscernibles theses applied to properties. Note that considerations of quantum mechanics only supports the possibility of indiscernible particulars, not indiscernible properties. I thank an anonymous referee for raising this concern to my attention.

Finally, and of most relevance here, properties have a causal and nomic role. Properties can be compared in terms of their causal and lawlike relations to other properties. Now, my interest is in causal essentialist identity of indiscernibles theses. These principles say that if properties P and Q are indiscernible with respect to their causal and nomic relations, then they are identical. I'll argue that we can construct continuity arguments against these theses, and that the same considerations that support Adams' argument also support these arguments. However, first I'll motivate the causal essentialist identity of indiscernible theses. We'll see that accepting prominent motivations of causal essentialism also motivate accepting an identity of indiscernibles thesis.[7]

2 Causal Essentialism

The core thesis of causal essentialism is:

Causal Essentialism (CE) Necessarily, for any property P, if P bears a causal or nomic relation to another property, then P necessarily bears that relation to that property.[8]

(CE) constrains what's possible. It rules out possibilities where a property bears causal and nomic relations differently from how it actually bears them. There are no possibilities where mass fails to interact with force and acceleration in the way it actually does. But does the causal essentialist further identify properties that are indiscernible with respect to their causal and nomic relations? I'm going to argue that the major motivations for (CE) also motivate

[7] Adams original case only makes use of a single world with nearly indiscernible spheres, and takes this to be a reason to accept a world with indiscernible spheres. My presentation of the argument uses a series of worlds that leads to the world with indiscernible spheres. I think this is a stronger way to present the argument, but I admit that this may not be what Adams originally had in mind, so this may only be an argument *suggested* by Adams. In an interesting forthcoming paper, Rodriguez-Pereyra (Forthcoming) criticizes Adams' argument, focusing on the premise that if there is a possible world with nearly indiscernible objects, then there is a possible world with indiscernble objects. However, focusing on a series of worlds brings to light considerations in favor of the argument that differ from the one's that Rodriguez-Pereyra considers in his paper. I will focus on these considerations in detail when I compare the continuity argument involving indiscernible spheres with the continuity arguments relevant to causal essentialism.

[8] For our purposes, we're only interested in properties that figure into causal or nomic relations. Some causal essentialists might restrict (CE) to certain properties, for example, they might not apply (CE) to spatiotemporal relations, cf. Ellis and Lierse (1994). Such a restriction will not affect my arguments so I set it aside.

identifying indiscernible properties. But it's worth first considering an initial reason to accept an identity of indiscernibles thesis that is independent of these motivations. Given that (CE) is true, we now face an explanatory burden. Why must a property necessarily bear its causal and nomic relations? For example, why must charge repel like charges and attract opposite charges? Now if properties are somehow individuated in terms of their causal and nomic relations then we have a ready answer. For part of what makes a property charge is that it repels like instances of itself and attracts opposite instances of itself. David Armstrong makes this point. If properties are individuated in this way then the necessity is, in his words, a "transparent and obvious necessity that holds … between property and manifestations in suitable conditions" (1997: 251). But, as he goes on to say, if properties are not individuated in this way, then the necessity is a "totally opaque, totally brute necessity" (ibid). So by endorsing an identity of indiscernibles thesis, the causal essentialist can avoid a commitment to these totally opaque and brute necessities.

Aside from this explanatory motivation, two prominent motivations for (CE) motivate an identity of indiscernibles thesis. First we'll see how they motivate (CE). In later sections, I'll argue that they also motivate identity of indiscernibles theses.

The Epistemic Motivation. Suppose it is contingent what causal and nomic relations a property has. In that case it should be possible to switch the causal and nomic relations that two properties bear to one another. For concreteness, let's consider Lewis's (1986a: 162) example of switching one of the quark colors C with one of the quark flavors F.[9] Now consider a possible world exactly like the actual world except that C and F have switched all of their causal and nomic relations, as well as their patterns of instantiation. So something is C in this world iff it is F in the actual world, and likewise something is F in this world iff it is C in the actual world. It seems like we would never have any grounds for knowing whether we are in the actual world or the alternative possibility. We would receive the same evidence in either possibility. Notice that in each world, C and F are distinguished by their differing patterns of instantiation; at the very least, they have instances in different locations. But this won't help us know which world we are in. For our only access to these properties is by way of their causal and nomic role, so we'll

[9] There are questions about exactly which properties can switch their causal and nomic relations that I want to gloss over. For example, Black (2000: 103) argues that the example involving quark color doesn't work. Nevertheless, if one isn't a causal essentialist, presumably there are some properties that can be switched in the way the example requires.

know that a particular causal and nomic role corresponds with a particular pattern of instantiation, but we won't be able to know whether C or F has that pattern of instantiation.

Some philosophers object to this sort of unresolvable ignorance, preferring a metaphysics that rules out these skeptical cases. If we hold that every property has its nomic relations essentially then we can rule out this rival possibility, for it is impossible that C and F switch their causal and nomic relations. This is the *epistemic motivation*.[10]

The Quiddistic Difference Motivation. The above example involving switching C and F is an example of a mere quiddistic difference. This is the property-theoretic analogue of a mere haecceitistic difference; the difference between two possible worlds that are qualitatively exactly alike, differing only with respect to which particular bears which qualitative properties (see Chisholm 1967). Likewise, in the case involving C and F, the only difference between the worlds is over which property plays which causal and nomic role and has which pattern of instantiation. However, just as some philosophers are skeptical of mere haecceitistic differences, there are philosophers suspicious of mere quiddistic differences, rejecting that we have two distinct possibilities. Rather, they hold that we have the same possibility differently described; a distinction without a difference. We can reject merely quiddistic differences by holding that every property essentially has its nomic relations, so it is impossible that C and F switch their causal and nomic relations.[11]

The rejection of mere quiddistic differences may be based on a modal intuition, but it can also be bolstered by appeal to a general methodological principle. In a slogan, the methodological principle is: don't distinguish without necessity. Hawthorne considers this line of thought. As he puts it: "all scientific knowledge about negative charge is knowledge about the causal role it plays. Science seems to offer no conception of negative charge as something over and above 'the thing that plays the charge role'" (2001: 368). If so, why distinguish between a property and the causal role that it plays? Admitting mere quiddistic differences involves making a distinction that science has no need for. In the absence of outweighing reasons, we

[10] Shoemaker (1980) and Bird (2007: 76-79) both appeal to this motivation.

[11] As in the case of the epistemic motivation, attempting to distinguish the properties on the basis of the location of their instances doesn't help, since the properties swap their patterns of instantiation between worlds. Further, holding that their patterns of instantiation are essential seems to be a non-starter. Surely it is contingent how, say, mass is distributed across spacetime.

ought not to make a distinction that science has no need for. In Hawthorne's words, "why posit armchair distinctions that are never needed by science" (ibid)? This is the *quiddistic difference motivation*.[12]

3 Structurally Indiscernible Properties

I'll now argue that these motivations push the causal essentialist to accept an identity of indiscernibles thesis. They require rejecting worlds where the laws have symmetries, where two properties play symmetrical roles in the laws. For example, consider a world containing all of our actual properties and laws, but also containing properties shmass and shmorce that bear nomic relations to other properties, forming the same nomic structure as our own laws, where shmass is symmetrical with mass and shmorce is symmetrical with force.

It will be helpful to consider a more abstract, but precise characterization. I'm going to simplify our discussion and assume that laws are relations between properties; though, this simplifying assumption is not essential.[13] Where A and B are properties, I'll represent a nomic relation between them as 'AnB.' This framework allows us to more precisely characterize the idea of properties playing symmetrical roles in the laws. As an example, consider a world with the following laws: AnC $\wedge$ BnC $\wedge$ (A $\wedge$ B)nD (see Hawthorne 2001, 373). Suppose as a matter of fact that A and B are distinct properties (though, as this stage I'm not supposing that a law explicitly states that A is distinct from B, later we'll reconsider this). A and B play the same role in the laws; so their places in the laws are symmetrical. This is easy to see if we Ramsify the lawbook, by replacing each predicate with a predicate variable and placing the appropriate number of quantifiers in front.[14] Ramsifying the lawbook gives us the purely structural features of the lawbook. This gives us $\exists F_1 \exists F_2 \exists F_3 \exists F_4 (F_1 n F_3 \wedge F_2 n F_3 \wedge (F_1 \wedge F_2) n F_4)$. Notice that nothing about the Ramsified lawbook can distinguish A's place in the laws from B's place. The sentence would be true if we replaced 'A' with 'F_1' or with 'F_2,' and likewise for 'B.' Since the

[12] Black (2000) argues against a Humean conception of properties on the grounds of mere quiddistic differences. Bird (2007: 73-80) develops this into an argument in favor of causal essentialism. See also Mumford (2004: 103-104, 151-152) and Kistler (2002: 69).
[13] This view is defended by Armstrong (1983), Dretske (1977), and Tooley (1977).
[14] This procedure is named for Frank Ramsey who developed it in his (1929).

place in the laws that A plays is symmetrical with the place that B plays, they play the same structural role in the laws. If two properties play symmetrical roles in the laws, say that they are *structurally indiscernible*. We can more precisely define this in terms of the notion of an open sentence obtained from a Ramsified lawbook. If we take a Ramsified lawbook and delete one of the quantifiers, this will give us an open sentence where one of the predicate variables is not bound by a quantifier. For example, we can obtain an open sentence from our above Ramsified sentence by deleting the first quantifier, giving us $\exists F_2 \exists F_3 \exists F_4$ ($F_1 n F_3 \wedge F_2 n F_3 \wedge (F_1 \wedge F_2) n F_4$); notice that F_1 is free in this sentence. A property satisfies an open sentence when a true sentence results from replacing the free variable with a predicate expressing that property. Finally, two properties are structurally indiscernible in a world iff the properties satisfy all the same open sentences obtained from the Ramsified lawbook of that world. Properties A and B both satisfy the above open sentence; when substituted for F_1 we get a true sentence. It turns out that A and B satisfy all the same open sentences obtained from the Ramsey sentence, so they are structurally indiscernible.

Accepting distinct, structurally indiscernible properties is in tension with the motivations for causal essentialism discussed above. Consider a world W_1 with the symmetrical laws just considered, and suppose that not everything that is an A is also a B. Now consider a second world W_2 just like W_1 accept we flip the pattern of instantiation of A and B. If x is A in W_1, then it's B in W_2; if it's B in W_1, then it's A in W_2. Worlds like this are a threat to the epistemic motivation. If we further suppose that the world is such that the only epistemic grip we have on A and B is in terms of their lawlike relations to C and D, then we will not be able to tell if we are in W_1 or W_2. We can tell that a particular object produced an instance of C in a lawlike way, but that won't tell us if the object was an A or a B. Given two separate instances where a C was produced we won't be able to tell if the same property produced C in both cases or if different properties produced C. So admitting these worlds runs afoul of the epistemic motivation. It might be objected that this skeptical case is not as worrying as the skeptical case originally used for the epistemic motivation. But it's hard to to see what would justify treating these cases differently. In both cases we are threatened with irremediable ignorance about which properties are playing which role.

As for the quiddistic difference motivation, W_1 and W_2 differ merely quiddistically. They only differ with respect to where the two properties are instantiated. So if we reject mere quiddistic differences, then we must deny that these worlds are distinct.

Given the epistemic and quiddistic difference motivations, and the explanatory burden to explain why a property necessarily bears its nomic relations, causal essentialists should reject the possibility of distinct, structurally indiscernible properties. They should accept the following identity of indiscernibles thesis:

Identity of Structurally Indiscernible Properties (SI) Necessarily, structurally indiscernible properties are identical.[15]

Aside from considering what possibilities this sort of causal essentialist rejects, we should also consider what possibilities they accept. I'm going to construct a continuity argument starting with possibilities that the causal essentialist accepts, so we need to know just what these possibilities are. A good model of a principled account of possibility can be seen by considering the causal essentialist's rival, the Humean. The Humean denies necessary connections between distinct existences.[16] In particular, the Humean denies that causal and nomic relations between properties are necessary. For the Humean, the contents of possible worlds can be freely recombined to generate a further possible world. The causal essentialist ought to have a principled account of what's possible that's analogous to the Humean's recombination-based conception of possibility. These principled accounts are a kind of principle of plenitude that tell us how plenitudinous the space of possibility is. John Hawthorne (2001: 370-371) has suggested a natural principle on behalf of the causal essentialist. The core idea is to allow that any way of defining a lawbook corresponds to a possibility. Making use of Ramsified lawbooks works well here. Ramsified lawbooks provide a natural way of defining possible properties and lawbooks in

[15] Bird (2007: 138-146) accepts (SI). Hawthorne (2001) considers this view at length calling it 'causal structuralism.' Schaffer (2005) also considers it, calling it 'nomic necessitarianism.' He classifies Ellis (2001), Ellise and Lierse (1994), and Kistler (2002) as proponents of this view, but considers the classification as largely indeterminate.

[16] The most prominent contemporary Humean is David Lewis. See Lewis (1986a: 86-92) and the introduction to his (1986b).

accordance with the causal essentialist, for they don't say anything about particular properties, only generally about the structure of the laws. So they won't say that a particular property bears nomic relations differently from how it actually does. Further, Ramsified lawbooks are unable to distinguish between properties that play symmetrical roles in the laws, as we saw when we considered the Ramsified lawbook from before. So it's natural to say that any logically consistent Ramsified lawbook is possible.

However, there's a difficulty. A Ramsified lawbook can explicitly say that symmetrical properties are distinct from one another by including a conjunct of the form '$F_n \neq F_m$.' In that case, while the Ramsified lawbook cannot distinguish between the symmetrical properties, it can guarantee that there are distinct, symmetrical properties. For example, consider our example of symmetrical properties again. We had the laws $AnC \wedge BnC \wedge (A \wedge B)nD$ with the corresponding Ramsified lawbook $\exists F_1 \exists F_2 \exists F_3 \exists F_4 (F_1nF_3 \wedge F_2nF_3 \wedge (F_1 \wedge F_2)n F_4)$. If we added the conjunct '$F_1 \neq F_2$,' then the Ramsified lawbook will guarantee that there are two distinct, structurally indiscernible properties.[17] If any logically consistent Ramsified lawbook is possible, then our principle of plenitude will contradict (SI). To remedy this we want the Ramsified lawbook to be completely neutral with respect to symmetries, so that the same Ramsified lawbook is consistent with the symmetrical properties being identical or with them being distinct. That way, whenever we have a Ramsified lawbook with different predicates playing symmetrical roles in the laws, (SI) will guarantee that the predicates refer to the same property. To achieve this, let's define a *structural lawbook* as a Ramsified lawbook that doesn't logically imply the existence of distinct, structurally indiscernible properties.[18]

Given this restriction, structural lawbooks are neutral with respect to distinct, structurally indiscernible properties, though regular, non-Ramsified lawbooks need not be. A structural lawbook that is true at a world with distinct, structurally indiscernible properties is also true at a world without them. Whereas there are regular lawbooks that are only true at worlds with distinct, structurally indiscernible properties, such as a lawbook that explicitly states that the

[17] On the way I'm understanding the predicate for the nomic relation, the conjunct '$(F_1 \wedge F_2)n F_4$)' does not imply that F_1 is distinct from F_2. It is consistent with them being identical.

[18] I don't mean to make a claim about whether the laws of nature generally do or don't explicitly say that two properties are distinct. I'm merely providing a framework for formulating a principle of plenitude for the causal essentialist.

symmetrical properties are distinct. So if we are merely asserting the possible truth of a structural lawbook we will never be committed to the possibility of a world with distinct, structurally indiscernible properties. We can now state our principle of plenitude:

Structural Combinatorialism (SC) For any logically consistent structural lawbook there is a world in which that lawbook is true.[19]

The combination of (CE), (SI), and (SC) gives us a clear conception of logical space. This view rejects worlds with symmetries in the laws, so any reason for thinking that such worlds are possible is also a reason for rejecting this version of causal essentialism. Indeed Hawthorne (2001: 373-374) and Schaffer (2005: 12-13) take our modal intuition that these worlds are possible to be a serious problem for this view.

However, we can also construct a continuity argument starting from possibilities that the causal essentialist accepts that involve nearly structurally indiscernible properties that lead to worlds involving structurally indiscernible properties. This continuity argument brings out further costs to rejecting worlds with distinct, structurally indiscernible properties.

Consider a world where one property is nomically connected with nine properties, and a different property is nomically connected with one property. Omitting the predicate quantifiers for readability, we can put the laws as follows: $FnG_1 \wedge FnG_2 \wedge ... \wedge FnG_9 \wedge HnI_1$ (with further laws that allow us to distinguish $G_1...G_9$ from one another).[20] (SC) guarantees that this world is possible. Imagine a range of worlds where we subtract one property from those that are nomically connected to the first property, and add one property to those that are nomically connected to the second property. Upon applying the procedure, the laws in the second world in the series are: $FnG_1 \wedge FnG_2 \wedge ... \wedge FnG_8 \wedge HnI_1 \wedge HnI_2$. After three more applications of the procedure, the laws in the final world of the series are: $FnG_1 \wedge FnG_2 \wedge ... \wedge FnG_5 \wedge HnI_1 \wedge$

[19] I have diverged from Hawthorne's principle. He does not add my restriction to guarantee that (SC) will not entail worlds with distinct, structurally indiscernible properties; instead he intends for it to have that consequence, see Hawthorne (2001: 373).

[20] I have in mind something like '$G_1nG_2 \wedge (G_1 \wedge G_2)nG_3 \wedge (G_1 \wedge G_2 \wedge G_3)nG_4$ ...' These laws allow us to distinguish $G_1...G_9$ from one another, but they won't affect the upshot of the case in the text. When we introduce more properties to be nomically connected to H, there are also laws that allow us to distinguish those properties from one another.

$HnI_2 \wedge ... \wedge HnI_5$. If F and G are distinct in this final world, then we have distinct, structurally indiscernible properties, for they satisfy all the same open sentences obtained from the Ramsified lawbook of this world.[21] This contradicts (SI), so the causal essentialist must hold that F and H are identical in this final world (as well as that the G properties are identical with the I properties).

There are a number of common features between this case and Adams' continuity argument that show in each case there is a serious cost to rejecting the final possibility containing the distinct, indiscernible entities. To be clear, I'm not saying that Adams himself draws attention to all of these features, rather I'm attempting to spell out features that makes Adams' case seem so intuitive, and show that they also apply to my case.

First, the cases mobilize our modal intuitions in a way that considering only the single world doesn't. When we consider the procedure that gives us the series of worlds, and that normally this procedure produces possibilities, there's a strong sense that the final world is possible too. In the two spheres case, normally making small changes to the spheres preserves possibility, each of the worlds before the final one is clearly possible. This produces a strong intuition that the final world is also possible. Likewise, in the symmetrical properties case, each of the worlds before the final world is possible, by the causal essentialist's own lights. So the procedure normally preserves possibility. This also produces the strong sense that the final world with distinct indiscernible properties is also possible.

Our modal intuitions seem sensitive to the idea that if a change preserves possibility, then, in general, that change continues to preserve possibility.[22] For example, it is possible that there could exist a single mug, or two mugs, or three mugs. This change of adding a mug preserves possibility in these cases, so it should continue to preserve possibility afterwards. It would be odd to hold that there is a specific, finite maximum number of mugs. The idea underlying this principle is that the possible and the impossible are extremely dissimilar from one another, so if two propositions differ in their modal status then they must be very dissimilar. But if some applications of a change are not enough to cross the divide from possibility to

[21] Assume that the laws that distinguish the G properties from one another and the laws that distinguish the I properties from one another are symmetrical so that once there are the same number of each, the laws don't distinguish the G properties from the I properties.

[22] See Rasmussen (2014) for one way of developing this idea.

impossibility, then continued applications should generally preserve possibility. This idea is, of course, very defeasible and can be overridden by other factors, but it does seem to play a central role in our modal epistemology.[23] This thought bolsters our modal intuition that the final world in each series is possible.

One might object that Adams' case is importantly disanalogous from my own case. In Adams' case we have the same spheres in each world in the series. Since the spheres are clearly distinct in the first world, and given the necessity of distinctness, it follows that they are distinct in the last world. This contrasts with my case because we have entirely different properties from world to world, so we cannot apply this reasoning. One might object that this difference makes for a strong intuitive difference between the two cases.

However, I don't think the difference poses a problem. While the transworld identity of the spheres in Adams' case may play some intuitive work, the question is whether there is something analogously intuitive about my case. Given the necessity of distinctness, we can't say that the two spheres are distinct in one world, yet identical in the final world. But we also need to make a further claim: that both of the spheres are in the final world. We need to rule out that only one of the original spheres (or a third sphere) are in the final world. The intuitive force of the case is that it is surely possible for the dent in the sphere to be slightly smaller, while both spheres still exist. But is there something analogously intuitive about my case? In my case, the key question is whether it is plausible to hold that in the final world in the series there is the same number of properties as there are in every other world in the series. But this seems very intuitive. Intuitively, it is possible to make a structural change to the laws without also making a much bigger structural change in the number of properties in the laws, particularly when this change doesn't affect the number of properties in every other world in the series. So while the fact that Adams' case involves the transworld identity of the spheres is a way in which his case differs from mine, I don't think my case is any worse for that.

Moreover, the transworld identity of the spheres in Adams' case is not essential. Some philosophers, such as Lewis (1986a) reject the transworld identity of any objects. On this view,

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[23] In particular, we need to beware of changes that are disjunctive; for example, the change of adding a mug unless there are five mugs, in which case a contradiction is made true. Clearly, this change will sometimes preserve possibility (whenever there are less than five mugs), but it won't always. That said, the changes made in both Adams' continuity argument and my own don't involve disjunctive changes of this sort.

an object inhabits only a single world. The *de re* possibilities for an object are understood in terms of counterparts of that object in different worlds.[24] But there is no bar to these philosophers finding Adams' argument powerful. Rather they can understand the case in purely qualitative terms, where we say that there are spheres in each world that have particular shape properties. The argument can be just as strong for these philosophers, so the transworld identity of the spheres is not essential to the case.

Second, both series reveal that the identity of indiscernibles theses are committed to unintuitive cases of counterfactual dependence. In Adams' case, if the indiscernible spheres are identical, then the number of spheres is counterfactually dependent on small changes to the qualitative nature of the spheres. For example, in the world right before the final world, we get the truth of strange counterfactuals like 'if the dent on the sphere were slightly smaller, then there would be fewer spheres' (cf. Adams 1979, 17). There is an unintuitive counterfactual dependence of the number of spheres on slight changes to the qualitative features of the spheres. A change that normally does not affect the number of spheres, given that in every other world in the series, a slight change in the size of the dent doesn't change the number of spheres. Likewise, in my case, we also get strange counterfactual dependence. If the structurally indiscernible properties are identical in the last world, then the number of properties is counterfactually dependent on small changes to the structure of the laws. In the second to last world if the structure of the laws were changed by adding a property and removing a property in the way described, then there would be fewer properties. The number of properties is counterfactually dependent on a small change to the structure of the laws that normally does not affect the number of properties, as can be seen by considering the other worlds.

Third, both series exhibit unacceptable gaps in logical space. As an example of the kind of gaps I have in mind, suppose we have a series of worlds containing a space with different numbers of dimension, we have a world with three dimensions, a world with four dimensions, a world with six dimensions, and so on. But there is no possible world containing exactly five dimensions. There's a clear sense in which this series is incomplete, it is missing a possibility.

[24] For more details, see Lewis (1968) and (1986a: 192-264).

Further, there's something arbitrary about this series; it seems arbitrary to allow some dimensions, but not the others. Yet nothing can be arbitrary about the space of possibilities.[25]

It isn't easy to say precisely what constitutes an unacceptable gap, but here's one way of spelling out the idea. It is natural to hold that the possible worlds form a sphere around each possible world in the sense that for any two possible worlds *w* and *w** and for any impossible world *i, w* and *w** are closer to one another than either is to *i*.[26] As usual, I'm understanding closeness in terms of similarity. So in other words, any two possible worlds are more similar to one another than either is to any impossible world. An unacceptable gap obtains when this is violated; that is, when an impossible world is closer to a possible world, than that possible world is to another possible world. We get these gaps when we have a series of worlds that corresponds to a natural ordering of similarity, but where there is a gap in the series; where there is an impossible world sandwiched between two possible worlds. In such a case, it seems that the impossible world is closer to the possible worlds that sandwich it, than they are to one another. A gap of this sort suggests that the space of possibilities is incomplete, for without it, the possible worlds don't form a sphere around each world. This makes sense of the case involving the dimensions of space, for the series demonstrates that an impossible world is closer to various possible worlds than they are to each other. A world with five dimensions is closer to a world with four dimensions and a world with six dimensions than the worlds are to one another, other things being equal. As another example, suppose it were possible for donkeys and dragons to coexist in any spatial arrangement, except they cannot be exactly one mile apart. This gives us a series with a gap where we start with a world where a dragon and donkey are two miles apart and each successive world in the series brings them closer and closer together. We have a gap where they are exactly a mile apart. Holding this seems unacceptable and we can make sense of that by seeing that the gap involves a case where an impossible world is closer to two possible worlds than they are to each other. The impossible world where the donkey and dragon are exactly one mile apart is closer to a possible world where they are just barely more than a mile apart and closer to a possible world where they are just barely less than a mile apart,

[25] On gaps in logical space, see Lewis (1986a: 86) and Bricker (1991: 610-611).
[26] This idea forms the basis of Kment's (2014) theory of modality. Lange (2009) makes use of a similar idea in his account of laws of nature.

than either possible world is to the other. This violates the idea that the possible worlds form a sphere.

Both Adams' series and my series demonstrate the the relevant identity of indiscernibles thesis involves an unacceptable gap in logical space. In each case we have a gap in a series that gives us a natural ordering of similarity, with a gap centered on the world with two qualitatively indiscernible spheres and a gap centered on the world with two structurally indiscernible properties. This gives us cases where a possible world is closer to an impossible world than to another possible world. A world with distinct indiscernible spheres stands 'in between' a world with nearly indiscernible spheres, and a world with a single sphere in two locations. Likewise, a world with distinct, structurally indiscernible properties stands 'in between' the world with nearly indiscernible properties, and the world where F and H are identical. These gaps seem to show that the space of possible worlds is not a sphere, and this gives us our problem. For it is extremely plausible that the possible worlds do form a sphere.

It is instructive to consider how one might respond to Adams' series. A prominent version of the identity of qualitatively indiscernible particulars makes use of the bundle theory, according to which the world fundamentally consists of bundles of properties.[27] On this view, we can describe Adams' series in such a way that it no longer involves a gap. For the fundamental facts in each world must be expressed in terms of bundles of properties. The fundamental facts have the following form: P, Q, and R are bundled together and T, U, and V are bundled together. It is important to note that there is no way of saying there are two distinct bundles of the same properties. Suppose we said "P, Q, and R are bundled together and T, U, and V are bundled together, and P, Q, and R are bundled together." This doesn't tell us that there are two distinct bundles of P, Q, and R, rather it merely repeats the same idea two times. This statement has the logical form of (using italic letters to represent propositions): '*P* and *Q* and *P*.' This statement adds no content beyond what is already in '*P* and *Q*.'

Let 'S' be the property of being spherical, and 'S_1' some maximally specific, nearly spherical shape property. Then the first world in Adams' series will be a world where S is bundled with several other properties, as is S_1. In the next world we replace S_1 with S_2, a

[27] See (O'Leary-) Hawthorne (1995) for more on the relationship between the bundle theory and the identity of qualitatively indiscernible particulars.

different maximally specific, nearly spherical shape property. This will gradually continue until the S_i properties lead to S, and we will simply have S bundled with several properties. But there doesn't seem to be a gap here, for there is no sense to be made of two distinct bundles of the same properties. Given this metaphysics, there is no impossible world that stands in between two possible worlds.

Set aside whether or not this ultimately helps defend the identity of qualitatively indiscernible particulars.[28] The important point to see is that the causal essentialist cannot make use of this defense. Let's consider what fundamental facts the causal essentialist accepts. So far, I've been understanding causal essentialism in terms of lawbooks. On this approach, the fundamental facts involve a lawlike relation holding between properties. But on this view, there is a clearly describable structure that the causal essentialist rules out; namely, one that explicitly says there are two distinct structurally indiscernible properties. This contrasts with the bundle theory, where there is no way to describe the rejected possibility in the bundle theorist's fundamental terms.

But let's consider whether there are different ways of understanding causal essentialism. A natural thought is to try to more closely parody the bundle theory. On one prominent approach, we conceive of properties as bundles of powers, as in Shoemaker (1980). Think of a power as telling us how two properties causally interact with one another. For example, mass has the power to produce force when it interacts with acceleration. We can regiment a power as (P, Q) which a property has just in case it produces Q when it causally interacts with P. So read the first place in the pair as the stimulus, and the second place as the result. We can now give the fundamental facts in terms of bundles of these powers, such as: (P, Q) and (R, S) are bundled together and (P, S) and (R, Q) are bundled together. At a first glance this achieves the same result as the bundle theory of particulars, because there is no way of saying that there are two bundles of the same powers.

However, there is a problem with this approach. The properties that show up in the powers are conceived of as bundles of powers. So we need some way of saying that a bundle of powers is itself a member of another bundle of powers. For example, P appears in a bundle

[28] Hawley (2009: 113) argues that there are difficulties with this response.

above, but P itself is a bundle of powers. For concreteness, let's say that P is the bundle of (F_1, F_2) and (F_3, F_4). Our description of the fundamental facts will need to include this bundle of powers, but it will also need to say that this bundle of powers is a member of another bundle of powers. It seems the only way we can do that is by treating bundles as singular terms, or introducing some kind of abstraction device that allows us to introduce corresponding singular terms. Once we do that we fix the problem. We can say that P is a member of a bundle of powers, and then we can say that P is identical with a specific bundle of powers. But this also leads to trouble, for once we treat bundles as singular terms, then we can say that two bundles of the same powers are distinct from one another. For example, we can say that P is identical with (F_1, F_2) and (F_3, F_4) being bundled together, and Q is identical with (F_1, F_2) and (F_3, F_4) being bundled together, and P is distinct from Q. Since the language for expressing the fundamental facts can express this possibility, we haven't removed the gap in logical space.

Of course a defender of (SI) could insist that preserving the identity of indiscernibles thesis itself counts for similarity to such a degree that the case doesn't involve an unacceptable gap. The impossible world containing two distinct, indiscernible properties fails to preserve this thesis, whereas the two nearby worlds do preserve the thesis. This is a principled way to avoid a commitment to a problematic gap, and preserve the idea that the space of metaphysically possible worlds forms a sphere. But this doesn't really address the case, for the series of worlds seems to challenge the idea that preserving (SI) counts very much for similarity. Suppose one held that there was no gap in the case involving the dimensions of space, because the impossible world with five dimensions is very dissimilar from the other worlds on the grounds that it fails to preserve *not having exactly five dimensions* which every other world in the series preserves. But clearly the series challenges thinking that preserving *not having exactly five dimensions* counts very much for similarity. Likewise, my case challenges thinking that preserving (SI) counts very much for similarity. So this response comes at an intuitive cost. The causal essentialist may hold that it is a price worth paying, but it's still a cost nonetheless.

Lastly, both series involve surprising constraints on the fundamental facts. Recall the principle of plenitude that we formulated for the causal essentialist. This provides a natural way of defining possible laws and properties in terms of Ramsified lawbooks. But what the series

show us is that this natural way of defining possible laws and properties leads us to a possibility that the causal essentialist rejects. Given that the structure of the laws comprises fundamental facts for the causal essentialist, this seems to be a surprising constraint on how the fundamental facts can be arranged. Recall that the principle of plenitude is constrained so that it does not generate any worlds containing distinct, structurally indiscernible properties. The series of worlds shows us that this is a mere stipulation on the possible ways of generating fundamental facts. It doesn't fall out naturally from the guiding idea behind that principle of plenitude, because the guiding idea leads to possibilities that the causal essentialist rejects. There's a kind of mismatch between how the causal essentialist constrains possibility and the causal essentialist's principle of plenitude. The simplest and most natural way to generate possibilities, from the causal essentialist's point of view, needs a surprising stipulation on it.

This issue also arises in Adams' case, though not as obviously because we don't have a principle of plenitude to work with. But we can see the general idea. The spheres case shows a surprising way in which the fundamental properties of the particulars are constrained. Normally, what fundamental properties one particular instantiates seems independent of the fundamental properties instantiated by distinct objects, but the series shows we cannot completely vary the properties independently, because once the spheres are indiscernible, they must be identical. So the fundamental facts are constrained.

Turning to the bundle theory is again instructive. For when we consider the case in the bundle theorist's terms, there is no surprising restriction. This simply falls out of the fact that for the bundle theorist there is no sense to be made of two distinct bundles of the same properties. But like before, the causal essentialist cannot avail herself of this response. As we saw above, in the analogue of the bundle theory, the bundle of powers theory, we can make sense of two distinct bundles of the same powers. So if the causal essentialists opts for a bundle theory of powers, there is a surprising restriction on how the powers can be bundled together. We still have an awkward restriction on how the fundamental facts may be arranged.

To sum up, my continuity argument brings out several costs to accepting (SI), as brought out by the four features we discussed. Now, (SI) constitutes a fairly strong identity of indiscernibles thesis. Many causal essentialists prefer to accept a weaker identity of

indiscernibles thesis. Indeed, as we'll see, this thesis avoids my continuity argument. Let's now consider that thesis.

4 Nomically Indiscernible Properties

Let's suppose the causal essentialist accepts worlds with symmetrical laws, avoiding the problems in the previous section. So the causal essentialist rejects (SI), allowing for worlds containing structurally indiscernible properties. This involves a retreat from the motivations we discussed. But there is a weaker indiscernibility thesis that the causal essentialist could instead endorse. Even if structurally indiscernible properties are accepted, the causal essentialist should still reject worlds where two properties have precisely the same causal and nomic relations. As an example, suppose that alongside our mass properties there was also a family of properties, the mass* properties, that are related to all the same properties in the same way as the mass properties. Corresponding mass and mass* properties have exactly the same nomic relations. For a more abstract case, consider the laws $AnC \wedge BnC$. Here A and B have precisely the same nomic relations. If two properties bear the same nomic relations, then they are *nomically indiscernible*. We can more precisely define nomically indiscernible properties similarly to how we defined structurally indiscernible properties. However, instead of using Ramsified lawbooks, we will use regular non-Ramsified lawbooks. We can obtain an open sentence from a non-Ramsified lawbook by substituting every instance of a predicate with a predicate variable, leaving the predicate variables free. So an open sentence we get from our above example lawbook is $FnC \wedge BnC$. Two properties are nomically indiscernible in a world iff they satisfy all the same open sentences obtained from the lawbook of that world. Notice that A and B satisfy the above example open sentence. They also satisfy all the same open sentences obtained from the lawbook, and so they are nomically indiscernible.[29]

[29] This way of defining nomic indiscernibility runs into difficulties in cases where the lawbook explicitly says that two properties are distinct. If the example lawbook $AnC \wedge BnC$ also includes the conjunct $A \neq B$, then A and B will no longer be nomically indiscernible. Consider the open sentence $F \neq B$. Only A satisfies this and not B. However, if one holds that properties are individuated on the basis of their causal and nomic relations, then this doesn't seem like a legitimate way of making A and B discernible. We can handle this by requiring that when we obtain open sentences from the lawbook, we also remove every atomic sentence involving the identity relation. But for simplicity, I'll set this complexity aside.

It will be useful to compare the two notions of indiscernibility. If two properties are structurally indiscernible, then they can be distinguished purely on the basis of the general structure of the laws that are part of. On the other hand, two properties are nomically indiscernible if they can be distinguished on the basis of the lawlike relations they bear to other particular properties. Here's how the two notions can come apart: consider the case of a family of properties, schmass, that are symmetrical with mass, where schmass is related to schmorce in the way that mass is related to force. Schmass and mass properties are structurally indiscernible from one another, for the Ramsified lawbook will not distinguish them from one another. However, they are not nomically indiscernible, for mass is related to force but not schmorce, whereas schmass is related to schmorce but not force. Note that if two properties are nomically indiscernible, then they are also structurally indiscernible. If open sentences obtained from the non-Ramsified lawbook don't distinguish them, then open sentences obtained from the Ramsified lawbook won't either. So the nomically indiscernible properties are a subset of the structurally indiscernible properties.

We can now formulate another identity of indiscernibles thesis:

Identity of Nomically Indiscernible Properties (NI) Necessarily, nomically indiscernible properties are identical.[30]

As we saw, the core motivations for causal essentialism also motivated (SI). So if the causal essentialist rejects (SI), then they can't do full justice to those motivations. Still, (NI) is a natural principle that is weaker than (SI), and it manages to do some justice to those motivations. Consider first the epistemic motivation. While the causal essentialist must now allow some skeptical cases, accepting nomically indiscernible properties would allow even more skeptical cases. Consider a world containing all of our actual properties and laws, but also the family of mass* properties that have all the same nomic relations that the mass properties have. So the mass properties are nomically indiscernible from the mass* properties. We could have different worlds simply by substituting the mass properties with the mass* properties, so that if something

[30] This version of causal essentialism is defended by Shoemaker (1980) and (1998). It is considered by Schaffer (2005) where he calls it 'causal necessitarianism.' See also the appendix to Hawthorne (2001).

has a particular mass property, then it has the corresponding mass* property, and *vice versa*. Assuming that our epistemic access to mass is limited by its nomic relations, by how it lawfully interacts with other properties, we would have no way of knowing which world we are in. Any property that is nomically indiscernible from another property will generate this skeptical worry. So if the causal essentialist wants to do any justice to the epistemic motivation at all, she must accept (NI).

Consider also the motivation from quiddistic differences. One might be willing to tolerate mere quiddistic differences due to structurally indiscernible, but nomically discernible properties. The causal essentialist might regard these worlds as a strange quirk of logical space needed to round things out in order to avoid the problems of the previous section. However, allowing nomically indiscernible properties leads to even more mere quiddistic differences. Consider our two worlds from above that differ only with respect to how the mass properties and the mass* properties are instantiated. These two worlds differ merely quiddistically. And it can be generalized to any world that contains a property which is nomically indiscernible from another property. So doing any justice to the mere quiddistic differences motivation requires accepting (NI).

I think it's clear that accepting structurally indiscernible properties is a genuine retreat for the causal essentialist since doing full justice to those motivations requires rejecting such properties. I leave it to the causal essentialist to justify rejecting (SI), while accepting the motivations for causal essentialism that I outline above. For my purposes, the important point is that even if the causal essentialist can't do full justice to those motivations, the causal essentialist should still reject nomically indiscernible properties in order to do some justice to them.

What principle of plenitude should we pair with this version of causal essentialism? It's natural to extend the previous principle of plenitude that made use of Ramsified lawbooks. In order to guarantee that this principle can guarantee worlds with symmetrical laws we lift our earlier restriction to Ramsified lawbooks that do not imply the existence of distinct, structurally indiscernible properties. So now our principle of plenitude can guarantee the possibility of distinct, structurally indiscernible properties. But we also want to ensure that our principle does not imply the possibility of distinct, nomically indiscernible properties. So let's define a *nomic*

lawbook as a Ramsified lawbook that doesn't logically imply the existence of distinct, nomically indiscernible properties. We can now state our principle of plenitude:

Nomic Combinatorialism (NC) For any logically consistent nomic lawbook, there is a world at which it is true.

So our new version of causal essentialism is the conjunction of (CE), (NI), and (NC). This version of causal essentialism avoids my previous continuity argument by accepting distinct, structurally indiscernible properties. However, the current version of causal essentialism rejects nomically indiscernible properties, and rejecting these properties also leads to a continuity argument.

Start with a world where one property is nomically connected to ten properties, and where a second property is nomically connected to one of the ten properties. So the laws in this world are: $FnG_1 \wedge FnG_2 \wedge ... \wedge FnG_{10} \wedge HnG_1$. What's different from before is that F and H are nomically connected to the same property: G_1. Now consider a range of worlds where we take one of the ten properties and let it be nomically connected to the second property. So in the second world, the second property is nomically connected to two properties from the ten properties. In this second world the laws are: $FnG_1 \wedge FnG_2 \wedge ... \wedge FnG_{10} \wedge HnG_1 \wedge HnG_2$. After nine iterations we will have a world where both the first and the second properties are nomically connected to the same ten properties. That is, the laws in the world are: $FnG_1 \wedge FnG_2 \wedge ... \wedge FnG_{10} \wedge HnG_1 \wedge HnG_2 \wedge ... \wedge HnG_{10}$. The nomic relations that F and H bear do not distinguish them; they are nomically indiscernible. So the causal essentialist cannot accept this final world if F and H are distinct. Rather the causal essentialist must hold that F and H are identical in this final world.

This case demonstrates the same four features that we saw in Adams' case and my previous case. We can be brief this time around. First, a series of worlds that leads to a world containing nomically indiscernible properties mobilizes our modal intuitions. Each world in the series before the final world is possible, and the worlds naturally lead to the final world, so the

final world also seems possible. Further, the series involves a change that generally preserves possibility, which inclines us to hold that it continues to preserve possibility.

Second, there are unintuitive cases of counterfactual dependence. In the final world if F and H are identical then there are eleven properties, whereas there are twelve properties in every other world. So in the world before the final world the number of properties is counterfactually dependent on the small change to the structure of the laws as described by the procedure. Further, this change normally doesn't produce a change in the number of properties, as can be seen by considering the other worlds in the series.

Third, we have a gap like before. The causal essentialist is committed to the impossible world where the nomically indiscernible properties are distinct being sandwiched between two possible worlds, the world containing nearly indiscernible properties, and the world where A and B are identical. The world before the final world containing nearly indiscernible properties seems to be closer to the impossible world than the world where A and B are identical, giving us an unattractive gap in logical space.[31]

Finally, the series brings out a surprising constraint on how the fundamental facts can be arranged. This series shows us that the way of generating possibilities by defining Ramsified lawbooks, as characterized by (NC), naturally leads to possibilities that the causal essentialist rejects. The restriction we placed in order to keep the principle of plenitude from generating nomically indiscernible properties amounts to a mere stipulation in order to keep the principle consistent with (NI). The series shows us that this stipulation is a surprising constraint on how the fundamental facts can be arranged. We have a kind of mismatch between (NC) and (NI).

5 Conclusion

Let's sum things up. We've seen that the there is good reason for the causal essentialist to accept an identity of indiscernibles thesis. Further, we've seen that the identity of indiscernibles theses are vulnerable to continuity arguments. These continuity arguments show

[31] Moreover, appealing to the bundle of powers theory doesn't help. For the same reasons discussed above, this approach won't remove a gap in logical space. The language for expressing fundamental facts, on this approach, still allows one to express the possibility of there being two distinct bundles of the same powers.

that accepting the identity of indiscernibles theses comes at a cost. I leave to the reader how damning these costs are. But at any rate we are better off recognizing the costs and commitments of these identity of indiscernibles theses. Moreover, the connections with Adams' continuity argument is telling. Many of us think Adams' argument is a fairly strong one. But if the causal essentialist rejects my continuity arguments, then it seems they must re-think Adams' argument as well.

If we agree that the identity of indiscernibles theses must be rejected, what's the best way forward for the causal essentialist? Since the epistemic motivation and the mere quiddistic difference motivation also motivate the identity of indiscernibles theses, these motivations must be abandoned, or greatly re-formulated. But one might appeal to other motivations for causal essentialism that I haven't considered here. For example, one might argue that the causal essentialist metaphysics gives us the best account of the laws of nature.[32]

Interestingly, some causal essentialists may welcome the results of my paper. An in-house dispute between causal essentialists is over whether we should think of properties as 'pure powers' or 'powerful qualities;' that is, over whether there is nothing to a property except its causal and nomic role, or whether a property has a qualitative nature that is essentially tied to a particular causal and nomic role.[33] If we think of properties as pure powers, then we must be committed to an identity of indiscernibles thesis. If there is nothing more to a property than its causal and nomic role, then clearly properties that are indiscernible with respect to their causal and nomic role are identical. So my arguments favor the powerful qualities view over the pure powers view.

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[32] For example, see Bird (2007: 81-98).
[33] See Heil (2004) and Jacobs (2011) for discussion.

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