# New Counterexamples to Humeanism about Laws of Nature

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**Abstract**

Humeanism about laws of nature is, roughly, the view that laws of nature reduce to patterns of occurrent events. In this paper I introduce a class of counterexamples to Humeanism. I start by considering two existing putative counterexamples to Humeanism and Humean responses. I then introduce a novel counterexample of my own. I show that this novel counterexample, and the previously suggested counterexamples, all fit into a larger unified class of cases. Seeing this unified class of cases points to the need for a unified Humean response to the counterexamples, and casts doubt upon the piecemeal responses that Humeans have given in the literature so far.

The biggest rift in the literature on laws of nature, and maybe in the metaphysics of science more generally, is between *Humean* and *anti-Humean* accounts of law. The Humean takes laws of nature to be, in some sense, not a substantial addition to the ontology over and above the patterns of events that make up the world – they take the laws to reduce to the patterns of events. The anti-Humean denies this, they think that the laws of nature stand above the mosaic of events, perhaps the laws even *govern* the events.

More precisely, take *Humeanism about laws of nature* to be the view that the laws of nature reduce to the *Humean Mosaic* — that is, the intrinsic physical state of each spacetime point (or each pointlike

object) and the spatio-temporal relations between those points — and that the Humean Mosaic is not further reduced to anything else.[1]

A large chunk of the literature on Humeanism has consisted in anti-Humeans developing putative counterexamples to Humeanism, and Humeans responding, one by one, to these counterexamples. In this paper I'm going to develop a new class of counterexamples to Humeanism. This class subsumes some counterexamples already in the literature. But, it also includes cases which are novel to the literature. The aim is, firstly and most obviously, to raise these new counterexamples as a problem for Humeanism. But secondly, I will suggest that because there is this unified class of putative counterexamples to Humeanism a unified response is required. A piecemeal Humean response, which takes the objections one at a time, will not get at the heart of the problem. In light of these counterexamples the Humean either needs a unified response, or to give up their view.

## 1 NON-SUPERVENIENCE AND NESTED COUNTERFACTUALS

Let's start by looking at a couple of objections to Humeanism that are common in the literature.

Perhaps the most common objection to Humeanism is the *non-supervenience* objection. Humeanism reduces laws to the Humean Mosaic, and thus implies that the laws *supervene* upon the Mosaic — any metaphysically possible worlds with the same mosaic also have the same laws. But this supervenience claim appears to be false — there appear to be worlds that match in their mosaics but differ in their laws. Such cases, then, are counterexamples to Humeanism.

Tooley (1977, p. 669), Carroll (1994, pp. 57-67) and many others describe such cases. But here is a particularly simple case (Maudlin, 2007, pp. 67-68): Consider a universe that just consists in an empty Minkowski spacetime. Such a spacetime is a model of General Relativistic laws.[2] So it appears

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[1] When there's no ambiguity I'll refer to the view simply as 'Humeanism'.

[2] That is, the truth of the propositions that are the laws of General Relativity are consistent with an empty Minkowski spacetime.

that there could be a world like this where the laws are General Relativistic. But, an empty Minkowski spacetime is also consistent with Special Relativity being the full story about spacetime and there being a different set of laws about gravitation. So it appears that there could be a world like this where Special Relativity is true and there is some non-General-Relativistic set of laws. But now we have two worlds — an empty-GR world and an empty-SR world — that match in their mosaics (both consist in an empty Minkowski spacetime) but differ in their laws.

The non-supervenience objection is that Humeanism is wrong about what is metaphysically possible – the laws do not supervene on the mosaic in the way that Humeanism suggests.

A different, but related, objection to Humeanism says that Humeanism gets the wrong results about certain counterfactuals, in particular, *nested counterfactuals*.

In order to press this objection, and for the rest of the paper, it will be useful to fix on one specific version of Humeanism — that is, one account of how laws reduce to the mosaic. It won't really matter which account we choose, and we don't need to fill out the account in full detail, but having some grip on how the reduction might go will be helpful.

Let's fix on by far the most popular Humean approach to laws: the *Best System Account* (BSA) (see Lewis, 1983, p. 42-3). Consider various sets of axioms and the systems produced by taking the logical closure of the axioms. The BSA says that these systems can have two virtues.[3] Firstly, a system is better if it is simpler, in the sense of the axioms being simpler. Secondly, a system is better if it is more informative about the Humean mosaic. The best system is the one which best balances these virtues. The axioms of the best system are the laws of nature.

This core idea needs to be filled out in a variety of ways to yield a full account – there is a very large literature on how to do this which I won't go into here. But for our purposes the core idea is enough — laws are propositions which give lots of information about the mosaic in a simple way.

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[3] Here I'm restricting to the case of deterministic laws.

Given this, consider the problem of nested counterfactuals. Assume that the laws of this world are General Relativistic. Then consider the following counterfactual:

If the world were empty then (if there were a massive object in the world then spacetime would be curved)

This counterfactual is true. The rationale is fairly simple. Given that GR holds in this world, if the world were empty then we would be in an empty-GR world. But in any world where the laws are those of GR it's true that if there were massive objects then spacetime would be curved.

But the Humean fails to get this result. We can see this by appealing to the BSA. In an empty world the BSA will not output the laws of General Relativity — the laws of GR do not provide the best balance of simplicity and informativeness with respect to an empty mosaic. Rather, the laws of the empty world would be much simpler — they would certainly not associate masses with curvature of spacetime. And so, if the world were empty we would not be in a world where the laws of GR hold and the counterfactual *if there were a massive object in the world then spacetime would be curved* would be false. Consequently, the whole nested counterfactual is false. This is the nested counterfactual objection. (Sklar (2014, pp. 79-80), Hall (2010a, pp. 32-33) and Lange (2009, pp. 53-54) raise objections of this form.)

What responses are there to the non-supervenience and nested counterfactual objections? The typical Humean response to the non-supervenience objection is to bite the bullet and deny the possibility of the cases that led to the problem. For example, denying that both the empty-SR and empty-GR worlds are metaphysically possible (see Earman and Roberts (2005, section 2), Loewer (1996, pp.192-194), Roberts (1998, p. 428-433), Beebee (2000, sections 5-6)).

These Humeans are rejecting an intuition we have about metaphysical possibility. If we are generous to the Humean we might think that this is a reasonable enough response — rejecting an intuition about metaphysical possibility is perhaps not too big a loss for the theory. Especially given that the authors cited above claim that we shouldn't be confident in the reliability of such intuitions in this context.

There has been less discussion of the nested counterfactual objection, but perhaps the most common Humean approach is to is to tweak the semantics of counterfactuals so that the Humean can get the desired result for the nested counterfactual. Hall (2010a, pp. 32-33) suggests a version of this approach. He suggests that in order to evaluate a counterfactual like 'if the world were empty then (if there were a massive object in the world then spacetime would be curved)' the procedure is as follows: The the first step is to find an empty world $w_1$ where the mosaic is a model of the actual laws. That is a world where the mosaic is consistent with the propositions that make up the actual laws, though not necessarily with the fact that those propositions are laws. Then we find the world $w_2$ closest to $w_1$ where the mosaic is again a model *of the actual laws* and there is a massive object in the world. If in $w_2$ spacetime is curved then the whole nested counterfactual is true.

It's not totally clear that this procedure gets the right result here – it depends on fine details of the closeness relation. And further, it's not clear whether this tweak to the semantics is well-motivated. In particular, this account implies that we should evaluate a counterfactual differently when it is embedded in a larger counterfactual than when it is not. This might make the response seem somewhat ad hoc.

But I'm not going to discuss this more here. The point of discussing these objections, for my purposes, is not to directly evaluate the possible responses. Rather, it's important to (i) see the structure of the counterexamples and (ii) note that the responses to the non-supervenience objection and the nested counterfactual objection — rejecting an intuition about metaphysical possibility and tweaking the semantics for counterfactuals — are *piecemeal*. They are directed specifically at, and only apply to, one particular objection. Rejecting the relevant intuition about metaphysical possibility doesn't help us with the nested counterfactual objection. And tweaking the semantics for counterfactuals doesn't help us with the non-supervenience objection.

In the next couple of sections I'm going to argue that there is a larger class of counterexamples to Humeanism which subsumes the non-supervenience and nested counterfactual objections. Seeing this larger class of counterexamples suggests that piecemeal responses do not get at the heart of the problem.

## 2   A Counterexample to Humeanism

In this section I'm going to introduce one novel counterexample to Humeanism. In the next section I'll show how it fits into a larger class of counterexamples.

The counterexample is going to involve *nomic* or *physical* possibility. So we should start by looking at the Humean approach to this grade of possibility. Physical possibility[4] is typically understood as a certain type of consistency with the laws. Here, for example, is a very natural account of physical possibility: A proposition is physically possible relative to a world $w$ if and only if it is true in a metaphysically possible world that has the same laws as $w$.

But, if the Humean accepts this account they face a problem. Assume again, that the laws of this world are General Relativistic. It seems, then, that is it is physically possible for the world to be empty. After all, nothing in the theory of General Relativity seems to imply any facts about objects existing. And as we noted earlier, an empty Minkowski Spacetime is a model of the laws of GR.

But, as we have seen, the Humean says that there cannot be an empty world where the laws are General Relativistic. And so, there is no empty world where the laws are the same as our world. Therefore, this approach to physical possibility implies that the empty world is physically impossible.

The standard Humean move here is to switch to a different account of physical possibility. (See, for example, Roberts (1998, p. 433), Schneider (2007, p. 312) and Hall (2010a, pp. 32-33).) This account says that a proposition is physically possible relative to a world $w$ if and only if it is true in a metaphysically possible world that is a model of the laws of $w$. That is, a proposition is physically possible relative to a world $w$ if and only if it is consistent with the the propositions that are the laws of $w$ (though not necessarily with the fact that those propositions are laws). This account allows that an empty world is physically possible, because an empty world is a model of the laws of the actual world.

But nevertheless, as, I think, has gone unrecognized in the literature, this second account also faces

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[4]I'm going to stick with this term.

problems – it leads to counterexamples to Humeanism. The reason is because it construes physical possibility as a restriction of metaphysical possibility when, for the Humean, there are some propositions that are intuitively physically possible but not true in *any* metaphysically possible world.

Here is a case which illustrates this. Imagine the actual world is Newtonian. The following situation then seems physically possible: There are only three bodies in the world. Two bodies orbit a central body such that at all times a straight line connects the centers of mass of all the bodies. The outer bodies are the same mass and are always at the same distance from the central body. Call this setup S. The gravitational forces in this case are such that the outside bodies orbit whilst the central body does not ever move because it is always equally attracted by the two outside bodies. So, here is a causal claim, call it C, that seems physically possible: S holds and the distribution of the outside bodies causes the central body to remain motionless forever.

But C is, very plausibly, not true in any metaphysically possible world for the Humean. Because for C to be true not only must it be the case that the mosaic is the way that was described in the last paragraph, but it must also be the case that something like the laws of gravitation hold so that the central body is held in balance by the outside bodies. And no such law would follow from the best system account applied to such a sparse mosaic. Rather, the best system of such a mosaic might say that bodies always orbit the center of the universe or something similar.

Consequently, Humeanism implies that there no world which is a model of the actual laws where C holds, and so C does not count as physically possible. This, then is counterexample to Humeanism. It is physically possible that C holds. But, it looks like the Humean does not get this result. Call this the *Causation-Possibility* objection.

## 2.1  A POSSIBLE HUMEAN RESPONSE

However, this reasoning does contain an assumption that a Humean might contest. It is key to the objection that there is a link between causation and the laws, so that if causal claim C holds then something like the law of gravitation must hold. Roughly speaking, the thought is that if A causes B then there must be the case that A nomically brings about B[5] given the relevant background conditions.

(Exactly how to formulate such a principle is a technical question, see, for example Davidson (1995) and Carroll (1994, chapter 5) but this question is not particularly important for our ends.)

So, perhaps the Humean could avoid the counterexample by denying this cause-law connection. And, of course, there are philosophers who have, independently of Humeanism, developed views which deny this connection — so called *singularists* about causation.

But is this a viable response for Humean? Let's look at a few ways that it could be developed (though space considerations force me to be brief). Here is the first: The thesis under consideration is *Humeanism about laws of nature* — the view that the laws reduce to the Humean mosaic. This thesis says nothing directly about causation. So, someone could defend Humeanism about laws of nature while denying *Humeanism about causation* — the thesis that causal facts are reducible to the Humean mosaic. On this approach causal facts could be totally distinct from facts about laws — they could even be primitive — thus allowing the Humean to deny the cause-law connection.

Although this is a consistent view, it's not a very attractive one. In fact, to my knowledge no one in the literature holds such a view. Typically, the reason that people defend Humeanism about laws of nature is because they are attracted to a broader thesis of Humeanism, one which denies any necessary connections between distinct existences. This broader thesis rules out denying Humeanism about causation. So the view which accepts Humeanism about laws of nature but denies Humeanism about causation looks strange, and rather unmotivated.

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[5]Or, if we are countenancing probabilistic laws, brings about a chance of B.

So, it looks like the Humean should accept both Humeanism about laws and Humeanism about causation. Given this, could they still deny the cause-law connection? The Humean has two options here. (1) They could reduce the laws in the mosaic, in the typical way, and then reduce the causal facts to the laws (along with the occurrent facts). Or (2) they could reduce causation to the mosaic directly.[6]

Option (1) is the mainstream Humean view (see, for example, Lewis (1986, introduction) and Albert (2000)). But if the Humean takes option (1) and reduces the causal facts to the laws then it looks like the cause-law link, or something in that spirit, will hold. A causal claim like C will hold only because it is grounded relevant laws. If C holds, then there has to be some law, like the law of gravitation, grounding C. Thus the causation-possibility objections not avoided.

So the Humean has to take option (2) – that causation is grounded in the mosaic directly – in order avoid the objection. But it's somewhat hard to see how this could work.

Firstly, it's hard to see how, in the case under consideration, the causal claim C could be grounded in the mosaic. After all, the world under consideration is very small — there are only three objects. And those objects don't do many interesting things — it's just two outer objects orbiting a central one. There isn't much there to suggest that there is some force from the outer objects holding the inner object in place, and so there is little material for any putative reduction.

Secondly, it's somewhat hard to see how to motivate a direct reduction of the causal facts to the mosaic. When we consider laws there are conceptions of the nature and roles of scientific laws that motivate such a reduction.Albert (2012), for example, stresses the informational role of laws — the idea that laws tell us a large amount of information about the world in a way that we can grasp and use. This thought motivates a reduction of the laws along the lines of the BSA.

Similarly, many Humeans (for example Loewer (1996, p. 188)and Hall (2010b, section 4.3)) suggest

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[6]Of course, there's a third option of reducing something else to the mosaic directly, and then reducing causation to that thing, whatever it is. For space reasons I'm just going to ignore such possibilities. But some of the considerations regarding (2) will apply to such views.

that the BSA reduction of the laws fits with the way that we go about discovering laws in actual scientific practice — by balancing theoretical virtues like the simplicity of theories with how accurate and informative the theories are. Thus scientific practice helps motivate the BSA.

Further, Loewer (1996, section 5) argues that reducing laws to the mosaic via the BSA makes sense of how the laws explain — they explain via unification. In fact, he suggests that the BSA can make sense of the explanatory role of laws better than anti-Humean views.

Of course, all these thoughts are highly controversial, and I'm not saying that we should accept them. But at least there are some reasonable ideas for how we can motivate a reduction of the laws to the mosaic. The case of causation seems dissimilar – it's not clear that there are features of the concept that could motivate a direct reduction to the mosaic. Or at least, there aren't existing suggestions for how we could motivate the reduction of causation in this way.

Reducing the causal facts directly to the mosaic is, then, not a particularly attractive option for the Humean. And neither is the other way of denying the cause-law link — denying Humeanism about causation. It is difficult, then, for the Humean to avoid the causation-possibility objection by denying the cause-law link.

## 3  A Class of Counterexamples

The causation-possibility objection is that the Humean gets the wrong result with respect to this proposition about the physical possibility of a certain causal claim, C. Comparing this problem to the other counterexamples we considered points to the root of the problem. Notice, and this is the key point, the proposition that C is physically possible holds in virtue of the mosaic *and the laws* of a *different possible world*.

In order to see whether C is physically possible we need to look for a different physically possible world, one where the mosaic consists in outside bodies orbiting a central one, as described above, and where

something like the laws of gravitation hold so that the outside bodies hold the central body. But, the Humean puts restrictions on how laws and mosaics can coexist — laws have to supervene on the mosaic, so some combinations of laws and mosaics allowed by the anti-Humean are not allowed by the Humean. These restrictions are why we cannot find such a world for the Humean and why they have the result that C is physically impossible.

Again, the key point is that the counterexample comes about because the proposition in question – the proposition that C is physically possible – holds in virtue of the laws, as well as the mosaic, of other possible worlds.

The nested counterfactual objection has a similar structure. The nested counterfactual we considered was: If the world were empty then (if there were a massive object in the world then spacetime would be curved). The truth of this depends upon the laws of another world. We evaluate this counterfactual by looking at the closest empty world and then seeing what the laws are in that world. If the laws are those of General Relativity, then it is true that if there were a massive object in the world then spacetime would be curved, and so the whole nested counterfactual is true. But, of course, the Humean will not think that the laws of GR hold in any empty world. They will take the laws to be much simpler, thus the counterfactual in the consequent would be false, and the whole nested counterfactual is false.

So, the nested counterfactual holds in virtue of the mosaic *and the laws* of a different possible world. In this case, the closest empty world. The Humean evaluates this proposition wrongly because of the restrictions it puts on how laws can combine with mosaics.

The non-supervenience objection is also of this kind. Consider the proposition that it is possible that there is an empty-GR world and an empty-SR world. This proposition seems to be true, but the Humean incorrectly evaluates it because it depends on the laws of other laws, as well as the mosaics, of other possible worlds.

So we can see, whenever there is such a proposition that holds in virtue of the mosaic *and the laws* of a

different possible world, the Humean is at risk of evaluating it incorrectly.

We now have almost a recipe for generating counterexamples to Humeanism. Take a proposition that has a component that pushes us to look at another possible worlds, and a component that relies upon the laws as well as the mosaic of that different world. Put these components together and we have a proposition that holds in virtue of the mosaic *and the laws* of a different possible world – the Humean will misevaluate some of these propositions.

For example, considering the physical possibility of a non-actual fact pushes us to consider other worlds. Considering the physical possibility of a non-actual causal fact makes us consider the laws as well as the mosaic of the other worlds. This is how the Causation-Possibility counterexample is generated.

Another example: Take a counterfactual, which pushes us to consider other possible worlds. Then nest within that counterfactual another counterfactual which forces us to consider the laws at those other possible worlds. This is how the nested counterfactual objection is generated.

We can create more counterexamples with this same recipe. Consider a counterfactual combined with an explanatory claim. For example: if the world were empty then the explanation for why spacetime would not be curved is that there are no masses in the world. I take it that this claim is true. Since General Relativity is actually true then if the world were empty then we would be in an empty GR-world. And in a such a world spacetime is flat only because there are no masses. But Humeanism implies that this counterfactual is false because in any empty world the laws would not associate masses with curvature of spacetime and thus the flatness of spacetime would not be explained by a lack of mass.

Or, another example: Consider a claim about the physical possibility of a explanation. Take the same case that we described in section 2 where two outer objects orbit, and hold in place, a central object. It seems physically possible that the objects orbit in the way described and that the explanation of why the central object remains motionless is because of the distribution of the outside objects. But, the Humean does not get this result. Again, the reasoning is very similar to before – Humeanism implies that in such

a sparse world nothing like a law of gravitation would hold, and so the outside bodies would not hold in place the central body.

Similar counterexamples can be cooked up by considering the physical possibility of certain counterfactuals and counterfactuals about causal claims.

## 4 CONCLUSION

So, we have a large class of counterexamples to Humeanism. All of the counterexamples involve the Humean incorrectly evaluating the truth value of propositions that hold in virtue of the laws and the mosaic of other possible worlds. This class includes existing counterexamples, like the nested counterfactual objection, but also includes novel counterexamples, like the Causation-Possibility objection.

Two substantial things have been achieved then. Firstly, we have uncovered new counterexamples to Humeanism. The Humean must deal with these counterexamples somehow if they are to defend their view.

Secondly, seeing that there is this unified class of counterexamples suggests that the Humean response must be unified. All of the counterexamples have the same source, so it is not enough to take each problem individually – they should be dealt with in a similar way.

This casts doubt on previous responses to counterexamples. As we noted earlier, we could try to respond to the non-supervenience problem by rejecting an intuition about metaphysical possibility. And we could respond to the nested counterfactual problem by tweaking the semantics for counterfactuals. Considered in an isolated way these responses might be reasonable. But when we consider the larger class of counterexamples the responses start to look like ad hoc fixes that don't get at the root of the problem.

One possible unified Humean response is to just wholeheartedly reject any intuition that might tell against Humeanism —whether it be about metaphysical possibility, or counterfactuals, or physical

possibility, or something else. But it's a little hard to see exactly what the independent motivation is for rejecting these intuitions. (Perhaps Beebee's (2000) thought that anti-Humean intuitions arise from an archaic, quasi-theological, view of nature could provide such a motivation[7]. But much more work, historical as well as philosophical, would have to done to defend such a view.)

There are other options for a unified Humean response – I don't have space to consider them more here.[8] But I hope to have shown that there is a lot more work for the Humean to do. The Humean needs to respond to these new counterexamples, and further, they need to find a unified response, otherwise, their view is untenable.

## References

Albert, D. (2012). Physics and chance. In Y. Ben-Menahem and M. Hemmo (Eds.), *Probability in Physics*, pp. 17–40. Springer.

Albert, D. Z. (2000). *Time and Chance*. Harvard University Press.

Beebee, H. (2000). The Non-Governing Conception of Laws of Nature. *Philosophy and Phenomenological Research 61*, 571–594.

Carroll, J. (1994). *Laws of Nature*. Cambridge University Press.

Davidson, D. (1995). Laws and cause. *Dialectica 49*(2-4), 263–79.

Earman, J. and J. T. Roberts (2005). Contact with the Nomic: A Challenge for Deniers of Humean Supervenience About Laws of Nature Part I: Humean Supervenience. *Philosophy and Phenomenological Research 71*(1), 1–22.

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[7] See also Loewer (2012, p. 132).

[8] But just to mention one, perhaps the revisionary conception of laws – the *meta-theoretic* conception – defended by Roberts (2008, pp. 357-361) potentially could allow the Humean to give a unified response, if they were willing to accept a radical change to the mainstream notion of lawhood.

Hall, N. (2010a). Humean Reductionism About Laws Of Nature. *Unpublished manuscript*.

Hall, N. (2010b). Humean Reductionism About Laws of Nature.

Lange, M. (2009). *Laws and Lawmakers: Science, Metaphysics, and the Laws of Nature*. Oxford University Press.

Lewis, D. (1983). *Philosophical Papers, Volume 1*. Philosophical Papers, Volume 1. Oxford: Oxford University Press.

Lewis, D. (1986). *Philosophical Papers, Volume 2*. Philosophical Papers, Volume 2. Oxford: Oxford University Press.

Loewer, B. (1996). Humean supervenience. *Philosophical Topics 24*(1), 101–127.

Loewer, B. (2012). Two accounts of laws and time. *Philosophical Studies 160*(1), 115–137.

Maudlin, T. (2007). *The Metaphysics Within Physics*. The Metaphysics Within Physics. New York: Oxford University Press.

Roberts, J. (1998). Lewis, carroll, and seeing through the looking glass. *Australasian Journal of Philosophy 76*(3), 426–438.

Roberts, J. T. (2008). *The Law-Governed Universe*. Oxford University Press.

Schneider, S. (2007). What is the significance of the intuition that laws of nature govern? *Australasian Journal of Philosophy 85*(2), 307–324.

Sklar, L. (2014). *Physical Theory: Method and Interpretation*. Oxford Univerity Press.

Tooley, M. (1977). The Nature of Laws. *Canadian Journal of Philosophy 7*(4), 667–698.