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Humean laws and circular explanation

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Abstract Humeans are often accused of accounting for natural laws in such a way that the fundamental entities that are supposed to explain the laws circle back and explain themselves. Loewer (Philos Stud 160(1):115–137, 2012) contends this is only the appearance of circularity. When it comes to the laws of nature, the Humean posits two kinds of explanation: *metaphysical* and *scientific*. The circle is then cut because the kind of explanation the laws provide for the fundamental entities is distinct from the kind of explanation the entities provide for the laws. Lange (Philos Stud 164(1):255–261, 2013) has replied that Loewer's defense is a distinction without a difference. As Lange sees it, Humeanism still produces a circular explanation because scientific explanations are transmitted across metaphysical explanations. We disagree that metaphysical explanation is such a ready conduit of scientific explanation. In what follows, we clear Humeanism of all charges of circularity by exploring how different kinds of explanation can and cannot interact. Our defense of Humeanism begins by presenting the circularity objection and detailing how it relies on an implausible principle about the transitivity of explanation. Then, we turn to Lange's (Philos Stud 164(1):255–261, 2013) transitivity principle for explanation to argue that it fairs no better. With objections neutral to the debate between Humeanism and anti-Humeanism, we will show that his principle is not able to make the circularity objection sound.

Keywords Laws · Humeanism · Explanation · Transitivity

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1 Humean explanation

Humeanism is the view that all contingent truths about a world supervene on the spatiotemporal distribution of fundamental properties, relations, and quantities had by fundamental entities (c.f. Lewis 1986). Call this distribution the *mosaic*. The truth of natural laws is not outside the explanatory reach of the mosaic. According to the Humean, laws are generalizations whose truth depends on the mosaic. Two worlds then have different laws only when the way the mosaic is distributed differs.

What kind of generalizations are laws? It cannot be that any generalization is a law. There are some that are only accidentally true. The Humean therefore needs to distinguish laws from law-like accidents. The usual way this is done is with the Best Systems Account (BSA). According to the BSA, *P* is a law if and only if *P* features in the simplest, most informative axiomatization of the facts about the world (c.f. Lewis 1983). It is only generalizations included in the best system for a world that qualify as that world's laws.[1] The other generalizations do not make the cut.

And that's all there is to the Humean view of natural laws. Inevitably, there are dissenters. Although Humeanism in conjunction with the BSA can distinguish between laws and accidental generalizations, Humeanism still entails that laws are generalizations. As a result, laws and accidental generalizations are made true the same way: by their instances. Their truth still supervenes on the mosaic. It is due to such supervenience that many charge Humeanism with circular explanation. Bird (2007, p. 86) puts his worry this way[2]:

> Laws have an explanatory capacity. They explain their instances, indeed they explain the regularities we find in nature. Could the laws fulfill this explanatory role if they themselves were regularities? Anti-Humeans allege they cannot. Facts may explain other facts but they cannot explain themselves.

Maudlin (2007, p. 172) voices a similar objection:

> If the laws are nothing but generic features of the Humean Mosaic, then there is a sense in which one cannot appeal to those very laws to explain the particular features of the Mosaic itself: the laws are what they are in virtue of the Mosaic rather than vice versa.

The objection in one form or another has been advanced by many other anti-Humeans like Armstrong (1983) and, most recently, Lange (2013). The argument is also simple. Humeans maintain that the mosaic explains the laws and the laws explain the mosaic. Since explanation is plausibly transitive, the mosaic appears to circle back and explain itself.

[1] We are papering over unrelated complications. For example, the Humean will have to account for chancy laws, which requires adding a third virtue like *fit* to measure how well a probabilistic system connects to a world (Lewis 1980, 1994).

[2] Bird presents a more detailed version of the argument after this passage that relies on a notion of "the ontological content of a fact or a set of facts" (Bird 2007, p. 87). We take the relation *being the ontological content of* to be a relationship of metaphysical explanation, and so we believe that our later discussion extends to Bird's argument too.

Let's call this the *circularity objection*. We think the objection rests on a misunderstanding about the nature of explanation and how different kinds of explanation interact. To defend this diagnosis, it will help to get the argument out in the open. The objection can be regimented in the following fashion:

THE CIRCULARITY OBJECTION

(P1)	The natural laws are generalizations.	(HUMEANISM)
(P2)	The truth of generalizations is (partially) explained by their positive instances.	(GENERALIZATION)
(P3)	The natural laws explain their instances.	(LAWS)
(P4)	If A (partially) explains B and B (partially) explains C, then A (partially) explains C.	(TRANSITIVITY)
(C1)	The natural laws are (partially) explained by their positive instances.	(P1 & P2)
(C2)	The instances of laws explain themselves.	(P3, P4, & C1)

The argument is valid and the conclusion is not something with which a Humean should want to be saddled. Which premise should be rejected? There are not many qualms to be had with GENERALIZATION or LAWS, and any worries are probably not going to be of use defending Humeanism in a substantive way. That leaves HUMEANISM and TRANSITIVITY. Now, TRANSITIVITY is not usually stated outright in presentations of the objection. It is often just assumed due to its initial plausibility.[3] It is not a surprise then that HUMEANISM is ditched by the anti-Humeans.

This objection strikes us as far too quick. Humeans and anti-Humeans should agree that law statements are universal generalizations.[4] As we see it, the sides disagree over what makes generalizations *true* and what makes them *laws*. So perhaps our first premise is misnamed. HUMEANISM (the premise) may follow from Humeanism (the view), but it by no means follows *only* from Humeanism. If we're right about this much, anti-Humeans are vulnerable to a *tu quoque*. When laws are statements taking the form of universal generalizations, even if the statements are rendered *laws* by something else (e.g. essential natures, relations to other laws), the statements are made true by instances of whatever the law is about. It is here that the specter of circularity appears. How can a law explain its instances if it is also made true by those instances?

[3] For passages where TRANSITIVITY appears to be assumed, see Armstrong (1983, p. 40), Bird (2007, pp. 86–87), and Maudlin (2007, pp. 171–175).

[4] Not everyone agrees that science is concerned with laws, with Van Fraassen (1989) being a notable dissenter. Other deny that laws have structure that is at all like that of law statements. Maudlin (2007) takes laws to be fundamental *sui generis* entities. But among those who agree that there are laws, it is still true that scientific explanation is done with sets of statements that answer why-questions. Accordingly, it is the law statements that feature in explanation and those statements take the form of universal generalizations. Because we are concerned with explanation, and because explanations are made up of statements, we will use 'law' to refer to law statements throughout.

Luckily, the anti-Humean does not need to look any further than these pages to find a strategy for cutting their own explanatory circles. Our own qualms with the circularity objection are completely bipartisan. We follow Loewer (2012) and maintain that the blame rests with TRANSITIVITY. Loewer notes there is a difference in the kinds of explanation at work in the Humean view of laws. There are *scientific* and *metaphysical* explanations. The explanation at work in GENERALIZATION is metaphysical: generalizations are true in virtue of their instances. And the type of explanation at work in LAWS is scientific: the laws explain their instances by showing their natural unity and similarity. TRANSITIVITY is then false because it traffics in ambiguity between the kinds of explanation in GENERALIZATION and LAWS. The mosaic metaphysically explains the truth of laws and laws help to scientifically explain the mosaic, but the mosaic does not explain itself.

Lange (2013) finds Loewer's rejoinder inadequate. He agrees that there are two kinds of explanation, but maintains that the metaphysical explanans scientifically explain whatever their explananda scientifically explain. So despite the different kinds of explanation being posited by the Humean, the mosaic still ends up explaining itself. To motivate this defense of the circularity objection, Lange presents and defends a revised version of TRANSITIVITY. For expository ease, we will use $explain_m$ to denote metaphysical explanation and $explain_s$ to denote scientific explanation. His principle is as follows:

> TRANSITIVITY*: If A explains$_m$ (or helps to explain$_m$) B and B explains$_s$ (or helps to explain$_s$) C, then A explains$_s$ (or helps to explain$_s$) C.[5]

When this principle is swapped in for TRANSITIVITY, a valid argument is produced that accommodates the distinction between kinds of explanation. It appears as if the Humean is saddled with circularity again.

What reason do we have to accept TRANSITIVITY*? Two reasons are briefly furnished by Lange (2013, p. 257). First, he argues that the principle is implicit in scientific practice and he gives a few examples to this effect. Second, he maintains that it is assumed by various philosophical arguments, especially those concerning the nature of genetic drift. We are not compelled much by either reason. What of the case against the principle?

2 Intransitivity

Our case against TRANSITIVITY* has three parts. As an opening salvo, we argue that the principle is ambiguous and so runs the risk of not motivating the circularity objection after disambiguation. Then, we present two problems with what TRANSITIVITY* requires of the interaction between metaphysical and scientific explanation. The first of these concerns cases where the two kinds of explanation are incompatible. The second problem concerns how TRANSITIVITY* requires an

[5] Our presentation of the principle differs slightly from Lange's (2013, p. 256). We have reversed the order of the conjuncts in the antecedent, and replaced talk of grounding with more general talk of metaphysical explanation.

untoward reductionism by dealing with the delicate issues of scientific reduction like a bull in a china shop.

2.1 The ambiguity problem

TRANSITIVITY* can be given eight distinct disambiguations depending on whether *explains* or *helps to explain* is most salient. And therein lies a problem. The disambiguations that are most likely to be true are not the disambiguations required to underwrite the circularity objection.

We will save the reader time by only discussing three disambiguations of TRANSITIVITY* because only three are relevant to the circularity objection. Keeping our earlier convention of using subscripts to denote the kind of explanation, these disambiguations are as follows:

FULL TRANSITIVITY: If A fully explains$_m$ B and B fully explains$_s$ C, then A fully explains$_s$ C.

PARTIAL TRANSITIVITY 1: If A fully explains$_m$ B and B helps to explain$_s$ C, then A helps to explains$_s$ C.

PARTIAL TRANSITIVITY 2: If A helps to explain$_m$ B and B fully explains$_s$ C, then A helps to explain$_s$ C.

Among these options, FULL TRANSITIVITY and PARTIAL TRANSITIVITY 1 and strike us as the most initially plausible. Unlike PARTIAL TRANSITIVITY 2, these disambiguations both start with full explanations in their antecedents. This is relevant to transitivity since far more is required for something to fully explain than for it to partially explain. By our lights, if something *fully* explains something else, then it seems like it could partially or fully explain the consequences of that other thing.

The circularity objection, however, rests upon PARTIAL TRANSITIVITY 2. According to the Humean, each instance of a law helps to metaphysically explain the law just as instances of a generalization help to metaphysically explain that generalization. But each instance does not *fully* explain the law. The lawhood of the law is fully explained by a complex fact involving all of its instances and some corresponding negative universal fact. We should also not forget the details added by adopting the BSA. The fact that *P is a law* is explained by all (or nearly all) of the world's fundamental facts, which are what determine whether some *P* is a part of the best system. So an instance of a law *P* partially explains that law metaphysically, the law partially explains its instances scientifically in conjunction with boundary conditions, but the instance does not explain the law scientifically.

PARTIAL TRANSITIVITY 2 could take us to explanatory circularity were it an acceptable principle. It is not, however, a principle that should be accepted. This is brought out by the the following vignette:

LION

The position of electron *e* partially metaphysically explains the position of lion *L*. The position of *L* scientifically explains the number of prey animals in region *R*. But the position of electron *e* does not explain the number of prey

> animals in region *R*. For if the electron were elsewhere, *L* would still be warding prey animals out of *R*.

Counterexamples such as this—which are easily replicated—reveal that partial metaphysical explanation is not transitive in the way required to get the circularity objection up and running. This is not too surprising. The transitivity of most varieties of explanation have been vulnerable to counterexamples for awhile. For example, Paul (2000) argues that causal explanation is intransitive and Schaffer (2012) provides counterexamples to the transitivity of grounding explanations. So we suspect this problem with PARTIAL TRANSITIVITY 2 falls out of a more general problem with the transitivity of explanation. As such, when other forms of full explanation cannot be taken as transitive across the same flavor of explanation, we think there is even less reason to believe that a partial explanation will be transitive in conjunction with a different kind of explanation.[6]

We have not yet shown that either FULL TRANSITIVITY or PARTIAL TRANSITIVITY 1 are false. A reader sympathetic to the circularity objection may still hold out hope that it can be rebuilt on a foundation made from one of these other principles. In what remains, we'll lump these disambiguations back together as TRANSITIVITY* and argue that no such transitivity principle can be true.

2.2 The interaction problem

Here's a story we like. Explanations are set of statements that answer questions about why something is such and so. What makes an explanation true is a relation in the world that links the explanandum and the explanans in the way described by the explanation. Not all explanations are alike, however. There are varieties of explanation. Differences between kinds of explanations correspond to the different kinds of relations that back them. Call such relations *backing relations* (c.f. Ruben 1990). The formal features of explanations vary according to their backing relation. An explanation is asymmetric when its backing relation is asymmetric. A different explanation could be symmetric were it to be backed by a symmetric relation. In this way, explanations mirror the relevant relation in the world.

Admittedly, this story about explanation is incomplete. It needs a flashy sequel where the missing details are filled in by a complete account of explanation. This is not a task taken up here.[7] Our aim is to show that TRANSITIVITY* is implausible in its general form. The likely story about explanation therefore provides what we think is an acceptable starting point from which to think about how kinds of explanation interact.

[6] Schaffer (2005, 2012) argues that counterexamples to the transitivity of causal and grounding explanations are evidence that these relations are *contrastive*, and so the relevant transitivity principles are contrastive as well. Perhaps a dedicated anti-Humean could revive the circularity objection with a contrastive principle. Having not seen such an argument, we are agnostic of its cogency. For reasons that will come in Sects. 2.2 and 2.3, we don't believe that even a contrastive principle can be formulated for linking scientific and metaphysical explanation.

[7] See Strevens (2008), Woodward (2003), and Ruben (1990) for accounts we think have something going for them.

On our story, the difference between scientific and metaphysical explanation is easy to exposit. They have different backing relations. Metaphysical explanations are backed by a variety of non-causal relations. Many are something like what Bennett (2011) calls *building relations*. These relations start with parts, properties, or individuals and then, from there, build up more parts, properties, or individuals. What individuates such relations is that the building materials are in some way prior to what's built, and what's built cannot typically build itself. There are many differences amongst building relations. They can differ according to arity, what they take as relata, the conditions needed for their obtaining, and so on.

Scientific explanations are similarly individuated by their backing relations. Unlike metaphysical explanation, there is not a wide plurality of scientific relations that can underwrite scientific explanation. Scientific explanations are typically understood to be backed either by causation, nomic connection, or some combination of these two relations. This does not mean that there is a consensus about the nature of scientific explanation. There is still disagreement over the exact details of the backing relations and the structure these relations back.

Two interrelated problems with TRANSITIVITY* now immediately arise. The first is that the principle is unmotivated. When one backing relation connects *A* and *B*, and a distinct backing relation connects *B* and *C*, there is no reason to think that either backing relation somehow connects *A* to *C*. As a result, TRANSITIVITY* predicts that backing relations obtain even when we lack reason to think they are present. The second problem is more serious. If the relation that backs *A* and *B* has features incompatible with the features had by the relation that backs *B* and *C*, *A* cannot explain *C* in the same way it explains *B*. This provides a simple recipe for constructing counterexamples. Pick a particular backing relation for a scientific explanation, pick an incompatible backing relation for the metaphysical explanation, and TRANSITIVITY* will be invalidated.

We suggested earlier that the anti-Humean is vulnerable to her own circularity problem. Here's a counterexample to TRANSITIVITY* she can get on board with. Suppose there is *immanent causation*. Causation is immanent when it proceeds from an object not by way of the object's parts, but from the object as a whole. Not everyone thinks there is immanent causation, but many anti-Humeans accept it because of the explanatory work they think it can accomplish (c.f. Armstrong 1997). Now suppose a view of composition on which the building materials are not identical to what they build. In other words, composition is not identity. The result is a situation in which parts compose a whole, but the parts do not scientifically explain everything caused by the whole because the whole can cause things immanently. TRANSITIVITY* is therefore false. Importantly, it is problematic for reasons that even some anti-Humeans accepts.

More counterexamples to TRANSITIVITY* can easily be provided by following our earlier recipe. We'll give one more, which will come as no surprise. We think the Humean account of laws is a counterexample. The metaphysical explanation that the mosaic provides for the laws is not backed by just any relation. The type of underwriting relation is a truthmaking relation. Lewis (1994, p. 474) thus remarks that "Humean Supervenience is yet another speculative addition to the thesis that

truth supervenes on being."[8] The explanation offered by laws for the mosaic, however, is backed by a very different relation. Laws explain why the mosaic behaves with uniformity and regularity. Whatever the exact nature of this backing relation, it is not a truthmaking relation. Yet, this is what TRANSITIVITY* predicts. That is a category error if there ever was such a thing. The explanation the laws help give of the mosaic is not an explanation of the mosaic's *truth*. The mosaic is a scattered arrangement of fundamentalia; it is not the kind of thing that can be true or false.

We conclude that TRANSITIVITY* is too coarse to be correct. Not only do explanations come in enough variety that there is no good reason to think that explanation is transitive in the way required, but such variety ensures that it cannot be transferred because the backing relations had by each explanation can behave very differently.

2.3 The levels problem

Let's move on to another problem. A natural picture of the world is that it has multiple levels. At bottom is physics, on physics rests chemistry, and on chemistry rests—in some way or another—biology, psychology, economics, and the other special sciences, with each scientific discipline and/or subdiscipline mapping out a structure of explanations within a level. An important explanatory task that requires both metaphysical and scientific explanation is spelling out how the world is constructed with various levels. Scientific explanations tend to be limited to the level of the discipline that's offering the explanation, and metaphysical explanations tend to focus on how the levels are built out of each other.

Within this picture, it is often worth asking which scientific explanations are *reducible* to those at a lower level. Some clearly are reducible. For example, explanations in thermodynamics are reducible to those of physics, and there is a general schema in statistical mechanics that details this reduction. Other scientific explanations seem to resist reduction. The explanations offered by macroeconomics do not appear to be reducible to the explanations of physics, nor do the explanations given by Darwinian evolutionary theory. This is true despite the fact that these facts supervene, and so are grounded in, facts about microphysics. In a slogan, the grounding of *facts* does not imply grounding of their *explanatory relations*.[9]

In other words, not every case of metaphysical dependence amounts to a scientific reduction. Two macro-level facts can both be grounded in microphysics without the laws that connect the macro-level facts being grounded in microphysics. Reducing the *laws* of a science to microphysics requires more than just reducing the *facts* of that science to microphysics. An example helpfully illustrates. For each white swan, there is a microphysical fact grounding that swan's being white. But

[8] The Humean has a few different ways they can understand this truthmaking relation. Typically, the relation is thought to be supervenience. But the Humean could think of the relation differently. For example, it could be a grounding relation in the style of Schaffer (2010) where grounding is contingent.

[9] We use *grounding* here and throughout loosely to denote something more intimate than supervenience. No commitments are made to a particular metaphysics of ground.

these facts—even taken together—do not ground the *generalization* or *law* that all swans are white. And so they don't ground explanations which appeal to that law.

TRANSITIVITY*, however, completely ignores the subtleties involved with answering this question about intra-level reduction. It insists that wherever there is metaphysical explanation, this automatically moves upward from the explanans to also explain whatever the explananda explain. Right away, this predicts widespread overdetermination. Causal explanations provide an easy illustration. When a baseball smashes a window, TRANSITIVITY* maintains that both the baseball and what metaphysically constitutes the baseball explain the shattering. This prediction takes us deep into controversial territory. Not everyone accepts overdetermination. Although some embrace it as a peculiarity of the world, others altogether eliminate objects or properties from their ontology on pain of allowing overdetermination. As a result, TRANSITIVITY* flatly contradicts principles like Kim's (1989) principle of causal exclusion, which denies outright that there can be two complete causal explanations of the same event.

But the cost TRANSITIVITY* incurs is not merely that it predicts overdetermination. This prediction is just a symptom. The problem is that TRANSITIVITY* cannot distinguish between cases when explanations from one science can be reduced to another, and cases in which they cannot. Even those of us comfortable with overdetermination should require that intra-level explanation tread the safer roads of principled reduction.

As another case of TRANSITIVITY*'s trouble, TRANSITIVITY* summarily dismisses the anti-reductionism of Fodor (1974). For Fodor, there can be reductive explanations only so long as they are accompanied by general bridge laws, or bridge definitions, between the differently leveled phenomena. When there are no such laws, the lack of systematic dependence on the higher-level science on the lower-level science makes the lower-level activity non-explanatory. TRANSITIVITY* insists this is all wrong: lower-level activity is explanatory even in the absence of bridge laws because whatever metaphysically builds scientifically explains that which it builds.

Finally, here's an example to show why Humeans should abandon TRANSITIVITY*. Callender and Cohen (2009) defend a version of the BSA tailored specifically for the special sciences. On their view, each special science autonomously constructs a best system for the natural kinds within its domain, but these natural kinds are different, and incomparable, ways of carving up the same underlying reality. Though the facts of a special science supervene on those of a lower-level science, they hold that there is no fact about which science is fundamental. So there is no systematic connection between the laws of the special science and the laws of physics, and explanations featuring these autonomous special science laws do not reduce to explanations featuring the laws of physics Again, TRANSITIVITY*, does not carry itself carefully. It maintains that the supervenience of the special science facts on the facts of physics implies that a reductive explanation exists.

We conclude again that TRANSITIVITY* is far too coarse to be correct. When it comes to explaining the layered nature of the world, TRANSITIVITY* both permits controversial overdetermination and licenses reductive explanations where no reduction can be found.

3 Conclusion

Natural laws are generalizations that explain their instances. According to Humeanism, the mosaic of instances makes the generalizations true and makes them laws. At a cursory glance, this appear as though the mosaic ends up explaining itself. But the charge of circularity is unfounded for the same reason supplied by Loewer (2012). The circularity objection relies on a principle about the transitivity of explanation that equivocates between kinds of explanation. As we have now shown, attempts to restitute the argument with a non-equivocating principle are prone to problems. A revised principle like Lange's (2013) was ambiguous in problematic ways, failed to attend to what distinguishes kinds of explanation, and did not accommodate subtleties in how the world's levels relate to each other. We suspect these and other problem will plague all similar principles.

The reader might see these problems as an invitation to go back to the drawing board. But a revised principle will unavoidably rely on a number of assumptions about the nature of explanation, overdetermination, and other issues of controversy. Each of these assumptions will then afford the Humean another opportunity to contest the circularity objection. Whatever indictments Humeanism may still need to answer to, we think we have given the Humean and the anti-Humean alike ample resources for seeing that a circularity problem is not among them.

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