Humeanism and the Power of Laws to Explain

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1. Introduction. According to many people who work on this stuff, the most important disputed question in the contemporary metaphysics of laws of nature is whether the right view of laws is a "Humean" one or a "Non-Humean" one. (Not true according to me; I don't think that's the most important question about laws. But I guess it's still pretty important.) Speaking very roughly, the so-called "Humeans" are the ones who think that laws of nature are great pervasive patterns in the world, whereas the so-called "Non-Humeans" think that the laws of nature are not those patterns themselves, but something else that is somehow responsible for those patterns -- something standing behind the course of events, or above it, or beneath it, or in some other metaphorical spatial relation to it, making it go on in the way that it does.

This talk is going to be about one particular argument against the Humean view that has been championed by David Armstrong, Tim Maudlin, and Marc Lange, among others. I'm going to try to present this argument in the strongest and most rigorous form that I can, and then explore a variety of strategies that a would-be Humean might use to resist it. I won't reach any definite conclusions, but I hope that I will convince you that the argument is not as devastating as it at first appears, and, more importantly, that reflecting on this argument can lead us to look at scientific explanation and the philosophical puzzles about it in new and potentially fruitful ways.

2. What is Humeanism? All of us, Humean or not, believe that our world contains a great many particular events and phenomena, laid out in a great space-time arena of some sort. It's tempting to think of this layout of events as forming a kind of four-dimensional mosaic (or maybe it has more than four dimensions, if String Theory turns out to be right): The stones in the mosaic are the particular events happening here and there, now and then, and what binds them all together into a mosaic is that they are fixed in certain spatiotemporal relations to one another. As I'll use the term "Humean" here, a Humean is someone who thinks that that mosaic is metaphysically fundamental, and the laws of nature are somehow derivative of it. In other words, what makes the laws the laws is that the great spatio-temporal mosaic of particular events is laid out in the way that it is. A law of nature just is a certain kind of general regularity found in the way that events are arranged in space and time. Not just any only old regularity in the mosaic counts as a law, though; only regularities of a special sort do. Humeans can disagree among themselves about exactly which sort is the special one. The main thing is that the nature of lawhood is such that the mosaic's being laid out in just the way it is is what makes some regularities laws of nature and others not. Non-Humeans, of course, are people who deny this: They think that in the metaphysical order of things, the laws of nature are at least as fundamental as the great mosaic -- some of them think they are even more fundamental. To use a familiar metaphor, Humeans think that you could build a world just like ours if you could gather all the right kinds of spatiotemporal pieces and put them together in the right spatiotemporal configuration; Non-Humeans think that if you just did that, you would leave out the laws.

Contemporary metaphysics offers us a great many different idioms we might use to express the Humean's claim: The laws of nature <u>reduce to</u> the great spatiotemporal mosaic of

local, particular events; the laws of nature are <u>grounded in</u> the mosaic; the laws of nature are

what they are <u>in virtue of</u> the mosaic's being laid out in the way it is; the lawhood of the laws is

<u>constituted</u> by the overall pattern of the mosaic; the mosaic is <u>more fundamental</u> than the laws;

features of the mosaic are the <u>lawmakers</u>; the mosaic is <u>ontologically basic</u> whereas the laws are

<u>derivative</u>. For purposes of this talk, I don't much care which idiom you prefer to use. But I'm

usually going to talk in terms of the <u>in-virtue-of</u> relation. For the Humean, the actual laws of

nature are laws of nature in virtue of the way the mosaic is arranged. (So in a manner of

speaking, the laws derive their lawhood from the consent of the governed -- thus, we might well

call this view Lockeanism instead of Humeanism.)

3. Humean Laws and Explanation: The Basic Difficulty. The argument against

Humeanism that I want to discuss here alleges that the Humeanism is incompatible with a certain

well-known and well-loved feature of the laws of nature: namely, their ability to help explain

particular events. For example, the path through spacetime taken by Halley's comet is explained

by the initial arrangement of bodies in the solar system, together with Newton's laws of

gravitation and motion. The problem is that this seems to stick the Humean with an

embarrassing circle. Part of what explains the orbit of the comet is a couple of the laws of

nature; but those laws are themselves grounded in the layout of the mosaic, of which the comet's

orbit is a part. So the comet's orbit is part of what grounds part of what explains the comet's

orbit. This looks like a vicious circle. See Figure 1 on your handout.

There's no doubt that you can depict this state of affairs as a circle of some kind, or at

least a closed curve. I proved this beyond the shadow of a doubt by drawing Figure 1. And it

seems, to me anyway, quite obvious that this Figure should give pause to any would-be Humean. However, a picture, all by itself, is not an argument. Why exactly should we think this circle is vicious?

4. An Explanatory Circle? Sometimes in the literature the problem is presented as a case of an explanatory circle, and explanatory circles are supposed to be very bad. For example, Armstrong and Maudlin[1] have both argued that on the Humean view, the mosaic explains the laws while the laws explain features of the mosaic. So we have a situation like that depicted in Figure 2 on the handout. Here we have some particular feature of the mosaic serving as part of an explanation of a law, which in turn serves as part of the explanation of that feature of the mosaic itself. Let's take it for granted that "a part of an explanation" means a non-redundant part of an explanation, and that an explanation is vicious if its explanandum appears as a non-redundant part of its explanans. In that case, what we have here sure looks like a case of a vicious explanatory circle, which is widely supposed to be impossible (setting aside outre scenarios involving time travel and the like).

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1. For example, Armstrong:

"Laws, however, explain uniformities. Even if we take the uniformity itself, that all Fs are Gs, it seems to be an explanation of this uniformity that it is a law that all Fs are Gs. But, given the Regularity Theory, this would involving using the law to explain itself." (Armstrong 1983, p. 40)

And, for example, Maudlin:

"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." (Maudlin 2007, p. 172

Barry Loewer[2] has offered a reply to this form of the complaint. He says that the situation in Figure 2 is an absurdity only if "explains" means the same thing in both of its occurrences. He claims that there are in fact two very different kinds of explanation, metaphysical explanation and scientific explanation. When we disambiguate the word "explains," we get Figure 3, in which there appears to be no vicious circle at all, since nothing ends up explaining itself in any univocal sense of "explains." The laws are appealed to in scientific explanations of the particular phenomena, whereas the particular phenomena are what metaphysically explain the laws. You can't have X scientifically explaining Y while Y scientifically explains X -- that would be a vicious circle. And you can't have X metaphysically explaining Y while Y also metaphysically explains X -- that would be a vicious circle too. But there's no problem, says Loewer, with having X scientifically explain Y while Y metaphysically explains X. If Loewer is right about all this, then this does seem to rescue the Humean from the charge of vicious explanatory circularity. I know by word of mouth, however, that many philosophers are suspicious that there is any notion of metaphysical explanation, distinct from that of scientific explanation, that will do the work Loewer needs it to do here. And let me just register that I share that suspicion.

A very different of way of rescuing the Humean from the charge of harboring explanatory circles was developed by Jim Dennison, a recent UNC undergraduate. Unlike Loewer, Dennison grants that the situation depicted in Figure 3 really would be a vicious circle, but he argues that the Humean is not really forced to admit that cases like this occur. Sure, the laws help explain particular events, and those laws are grounded in some pattern in the great Humean mosaic or particular events, but, Dennison argues, we need not agree that any particular event plays a role in the metaphysical explanation of the law that explains it. For, Dennison

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2. Loewer 2012.

argues, it is plausible that to be part of the explanation of some phenomenon, you have to be a difference-maker for that phenomenon. And it might well be the case that, for example, the trajectory of Halley's comet is not a difference maker for the law of gravitation. And in fact, Dennison makes a pretty plausible case that the trajectory of Halley's comet is not a difference maker for the law of gravitation, and so should not show up in any good metaphysical explanation of why the law of gravity is a law. (If you want to see the details, read Dennison's thesis.)

So, if the problem that Figure 1 poses for the Humean is really a problem about explanatory circularity, we have at least two interesting ways of dealing with that problem. But I don't think that this really gets at the heart of the matter, because I don't think that the deep difficulty for the Humean here has to do with an explanatory circle at all.

5. Scientific Explanation and the In-Virtue-Of Relation. Remember that as I originally posed the problem, it didn't have to do with metaphysical explanation -- whatever that is, exactly. It had to do with grounding, and the in-virtue-of relation . It's notoriously hard to give a precise definitions of these things, but the basic idea is supposed to be that X grounds Y, and Y is the case in virtue of X, just in case what Y's being the case consists in, is something that is somehow already involved in, X's being the case.

For example, Ram Neta is a parent in virtue of having two children, seven-year-old Sofia and five-year-old Avi; the existence of Sofia and Avi along with their relation to Ram, are what provides for Ram's parenthood. Now if, like Dennison and many others, you think that explanation has something important to difference-making, you might think that the explanation

of why Ram is a parent shouldn't mention both of these children. Maybe it should just mention the older child Sofia, since Ram would still have been a parent even if Avi had never have been born. Or maybe it should just existentially quantify over his children.

Similarly, according to the Humean, what makes this a world where mass-energy is conserved -- if that's what it is -- is that its spatiotemporal mosaic of particular events has certain general characteristics. Presumably, not each and every feature of the mosaic is crucial to the lawhood of this law; not every element of the mosaic is a difference-maker to its important general characteristics. But still, as things are in the actual world, it is the mosaic's having all these elements arranged in just this way that provides for the lawhood of the law. So it is a law in virtue of this whole mosaic's being the way it is.

We can usefully separate this notion of "in-virtue-of-ness" out from the idea of "metaphysical explanation"; for the rest of this talk I'm just going to forget about metaphysical explanation and focus on the in-virtue-of relation.

It's also notoriously hard to give a precise account of <u>scientific</u> explanation. But for our purposes it will suffice to focus on one particular kind of explanation that laws of nature are widely assumed to figure in; I have in mind covering-law explanations of the occurrences of particular events. Thus is the kind of explanation that you give when you describe the initial conditions and boundary conditions of some system at a time, and show how the laws of nature lead the system to evolve from that state into a later state which includes the occurrence of the event in question. So for example, Empedocles fell into the mouth of the volcano Etna <u>because</u> at a certain time, he had a certain mass, he was in mid-air above Etna's mouth traveling with a certain velocity, he was subject to no non-gravitational forces (such as Love or Strife), and the law of gravitation together the second law of motion entail that any object with those properties

will travel along a trajectory that intersects the surface of the volcano's mouth. (As he was portrayed in the Phaedo, Socrates would presumably have been quite unhappy with that explanation of why Empedocles fell into the mouth of Etna, but by modern scientific standards, it's pretty good.)

This is, of course, the kind of explanation that Hempel and Oppenheim tried to treat first in their 1948 paper "Studies in the Logic of Explanation." I'll call explanations like these GVCLEs (pronounced "givicklees"), for "Garden Variety Covering-Law Explanations." Intuitively speaking, it seems fair to characterize a GVCLE as an account of how the evolution of the universe brought about the explanandum event. Now of course, there are notorious cases of putative explanations that fit this model but seem like terrible explanations; Sylvain Bromberger's case of the shadow and the flagpole is the most famous. But what I want to say here is that if the universe is deterministic, then putative explanations of this form, GVCLEs, very frequently are clearly good scientific explanations, and it is not implausible that every event in the universe (possibly excluding the big bang) can be given a legitimate explanation of this form, even if many events can also be given explanations of other forms that are in many respects superior. If the universe is not deterministic, then of course things will be a bit more complicated, but not, I think, in a way that will make a difference tot he argument to follow, so I'll try to keep things simple by presuming that the world is deterministic.

Now, let's go back to Figure 1. There definitely seems to be something suspicious about the state of affairs depicted here. But it's perhaps not as obvious exactly what the problem is. I suggest that the worry stems from three very plausible ideas:

- In a typical GVCLE, each law invoked -- including the fact that it is not merely true but also a law -- is part of the explanans. That is, the fact that this law is a law is part of what does the work of explaining whatever is getting explained. Call this the principle that <u>laws are explainers.</u>

- Explanatory circles are impossible -- or if not impossible, they should at least not be ubiquitous. Or, at least, they should not be ubiquitous in worlds like ours. For example, in certain time travel scenarios, the occurrence of an event might help to explain itself. And in certain metaphysically possible universes where time has a cyclical structure, it might be that every event plays a role in explaining itself. But it shouldn't be the case that in normal universes, like the one we think we live in, every event is involved in an explanation of itself. That would be too weird. Call this the thesis that <u>self-explanation is not ubiquitous.</u>

- Scientific explanations track real relations among real aspects of the world. These relations hold among components of reality themselves -- not the concepts or propositions or sentences we use to represent them. So if the solubility of NaCl is capable of scientifically explaining something, then so is whatever aspect of reality in virtue of which NaCL is soluble. And more generally, if Y partly scientifically explains Z, and Y is the case partly in virtue of X's being the case, then X partly scientifically explains Z too. Call this the thesis that <u>scientific explanation transfers across the in-virtue-of relation.</u>[3] This thesis is illustrated in Figure 4.

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3. This is very closely related to the transitivity principle" put forward by Lange (2013) in his reply to Loewer.

If we accept all three of these very intuitively plausible principles, then we can account for why the situation depicted in Figure 1 seems to be absurd.   We have a scientific explanation of a particular element, x, of the great mosaic. By the thesis that laws are explainers, a certain law of nature is part of what explains x. By the thesis that explanation transfers across the in-virtue-of relation, it follows that the entirety of the way the mosaic is laid out is part of an explanation of x. But x itself is part of the great mosaic. So x helps to scientifically explain itself. But this x could have been any event that can be explained by a GVCLE. Since it is plausible that pretty much any event can be explained by a GVCLE, this means that self-explanation is ubiquitous. But that's just wacky. So the situation depicted in Figure 1 is absurd, and since Humeanism about laws is committed to there being situations like that one, it's got to be false.

6. The Argument that Threatens Humeanism. A bit more formally, we can cast the argument as follows. Note: Throughout this argument and the discussion to follow, I will use "scientific explanation" as a success term. I will also use "GVCLE" to mean a garden-variety covering-law explanation that is a good scientific explanation (so I exclude, e.g., the flagpole-shadow case).

1. Every GVCLE includes in its explanans a law of nature. (Premise; the laws-are-explainers thesis).

2. If S is a scientific explanation of a particular event E, and the explanans of S includes s, and V is the set of facts (or whatever) in virtue of which s holds, then the explanation that results from plugging in V for s and leaving the rest of S alone is just as good a scientific explanation of E as S itself is.   (Premise; the explanation transfers across the in-virtue-of relation thesis)

3. If S is a GVCLE that explains event E, then the explanans of S includes at least one law, and the account that results from replacing one of the laws in S's explanans with the facts in virtue of which that law holds is itself a scientific explanation. (Follows from 1 and 2)

4. If Humeanism is true, then each law of nature holds in virtue of the entire layout of the mosaic. (Premise; from the definition of Humeanism)

5. So, if Humeanism is true, then what you get if you start with a GVCLE and replace a law in its explanans by the entire layout of the mosaic, you end up with a scientific explanation of the GVCLE's explanandum-event. (Follows from 3 and 4)

6. The explanandum event of any GVCLE is part of the entire layout of the mosaic. (Premise; follows from definition of "the mosaic.")

7. So, if Humeanism is true, then for any event that can be explained by a GVCLE, there is a scientific explanation of that event whose explanans includes that event. (Follows from 5 and 6)

8. Many events that can be scientifically explained by GVCLEs cannot be scientifically explained in part by themselves. (Premise; the self-explanation-is-not-ubiquitous thesis.)

9. Therefore Humeanism is false. (Follows from 7 and 8)

Henceforth I'm going to call this "the threatening argument." I think this sure <u>looks</u> threatening. And I submit that any would-be Humean who didn't at some time feel a little sick to the stomach about it would have to be peculiarly insensitive to argument. (I realize that many Non-Humeans believe that this peculiar insensitivity is endemic among Humeans. This belief is both false and dangerous, but that is a topic for a different occasion.)

The argument is evidently deductively valid, so the Humean who wants to keep on being a Humean needs to find a good reason to reject one or more of the premises. There are five premises. I take it that the premises in lines 6 and 8 are both non-negotiable. This leaves us with three premises that an erstwhile Humean might challenge: The ones in lines 1, 2, and 4. In the rest of the talk, I'm going to discuss one rationale for denying each of these three premises.

7. Challenging Premise 4. By definition, a Humean is someone who thinks that the laws are as they are in virtue of the layout of the mosaic. But must a Humean say that the <u>entire</u> mosaic is that in virtue of which the laws are what they are? Why couldn't some subset of the mosaic suffice to make the laws what they are? The obvious answer is that for any given law of nature L, if you just look at part of the great mosaic, then for all you know, the part you left out might contain a counterexamps the whole mosaic to make a law a law.

But a Humean might take a relaxed position on the truth of laws. For example, David Braddon-Mitchell (2001) has argued for a Humean account of laws according which laws of nature are generalizations that are true for the most part, though they may the odd exception here or there. (Notice that this is quite different from the familiar but false claim that all laws of nature are really ceteris-paribus laws, which state only that some regularity holds so long as nothing interferes. In the case of a ceteris paribus law, it could be the case that something is

always interfering, so that the regularity is not true for the most part, but rather entirely false. This is the view of the early Nancy Cartwright (1983), for instance.) On Braddon-Mitchell's view, it might well be sufficient to look at a subset of the entire mosaic in order to tell what the laws of nature are.

A Humean who accepted a Braddon-Mitchell type view might say that the laws are what they are in virtue of any large-enough subset of the great mosaic. Of course there is no one subset that is privileged here; you could look at any large-enough portion of the mosaic you like -- any one that leaves out a small handful of tiles, say -- and what the layout of that portion of the mosaic is like would suffice for the laws' being as they are. So the laws are what they are in virtue of any of a large number of different portions of the mosaic -- including the entire mosaic. Having said this, the Humean could then insist on a small modification to Premise 2: Since there is no <u>unique</u> subset of the whole mosaic which is that-in-virtue-of-which-a-given-law-holds, the set V mentioned in premise 2 is not unique. To allow for this non-uniqueness, premise 2 should be reformulated:

2'. If S is a scientific explanation of a particular event E, and the explanans of S includes s, then there is at least one set of facts (or whatever) V in virtue of which s holds, then the explanation that results from plugging in V for s and leaving the rest of S alone is just as good a scientific explanation of E as S itself is.

With this change made to line 2, and line 4 rejected, the argument fails. In the case of any give GVCLE that explains event E, the laws occurring in the explanans could all be made

true by a portion that includes most of the Humean base but leaves out E itself, so that there is no self-explanation.

So, there's <u>one</u> way a Humean could resist the argument, if she were willing to give up on the idea that laws are universally true regularities.

8. Challenging Premise 1. How could it fail to be the case that a covering-law explanation includes a law of nature in its explanans? Here's how: It could be that in a GVCLE, the law is not itself part of the explaanns, but only a principle in virtue of which the initial conditions are able to explain the explanandum-event. To see how this idea might be both viable and relevant, recall one of the lessons we learned from Lewis Carroll's paper "What the Tortoise Learned from Achilles": There is an important distinction between axioms and rules of inference. In the following logically valid inference:

P

If P, then Q

Therefore (by modus ponens), Q

Modus ponens is playing the role of a rule of inference. If instead, we treated modus ponens as logical axiom and added it to our premises, we would find ourselves in this situation:

P

If P, then Q

For any U, V: (Whenever U and (if U then V), then V)

And now we need another, more complex rule of inference to tell us how to get from these three premises to the conclusion that Q. And this is the beginning of an irritating infinite regress. To stop this regress from starting, we have to realize that in the original inference, modus ponens is not itself one of the premises, but is rather a principle that tells you that you can infer this conclusion from these premises. In other words, <u>it is not one of the things that jointly entail the conclusion; rather, it is the principle by which those things do entail the conclusion.</u>

Similarly, I want to suggest that perhaps, in a covering-law explanation, <u>the law is not one of those things that jointly explain the explanandum; rather it is the principle by which those things do explain the explanandum.</u> The initial conditions cited in the explanans are what do all the explaining. The law that the explanation cites is simply the principle that initial conditions like those are able to explain events like this.

If this is the right way to think about the role that laws play in covering-law explanations, then premise 1 of the threatening argument is false, and the argument is stopped dead in its tracks. Humeans are not committed to cases of self-explanations after all. Cases that seem to be well-represented by Figure 1 are in fact better represented by Figure 5. Here, nothing is part of any explanation of itself.

8. Challenging Premise 2. Premise 2 is just what I earlier called the thesis that explanation transfers across the in-virtue-of relation; it's the one illustrated by Figure 4.

On one model of explanation, this seems exactly right: I mean the causal model of explanation, according to which what you have to do to explain some event is indicate what it is about the universe in virtue of which that event was <u>brought about</u>. So suppose that Y explains Z

in just that way -- that is Y includes information about what it is about the world that brought about the event Z. Now suppose that Y is true in virtue of X. It is only natural to suppose that the "in virtue of" relation is transitive.   So if Y includes the facts about the universe in virtue of which Z was brought about, and Y holds in virtue of X, then Z must have been brought about in virtue of the facts included in X. Thus, X provides a causal explanation of Z. And this seems to vindicate the thesis that explanation transfers across the in-virtue-of relation.

And I think I agree that in the case of causal explanation, whatever it is in virtue of which the explanans holds itself must be capable of explaining the explanandum. But GVCLE's are different from causal explanations. Despite the superficial appearance that GVCLEs really are causal explanations, with the initial conditions being the causes and the covering-laws being the general causal principles whereby they are causes, philosophers of science have recognized for a long time that to give a covering-law explanation of some phenomenon is neither necessary nor sufficient for giving a causal explanation of it. And I want to suggest that in fact covering-law explanations function very differently from causal explanations.

What any kind of explanation has to do is help us <u>make sense of</u> the explanandum. But the phrase "make sense of" is said in many ways. Causal explanations help us make sense of events by telling us how they were brought about. But covering-law explanations, I suggest, do something very different. They help us make sense of events by locating them within a general pattern of a certain sort. Explanations that work like this need not conform to the general principle that explanatory power transfers across the in-virtue-of relation.

To see this, consider the well-worn example of Arbuthnot's regularity, discussed to great effect by Philip Kitcher.[4] Arbuthnot noticed that in each year from 1629 to 1710 in each year, more boys than girls were born in London. It is not believable that this was a mere coincidence.

Presumably, there is an explanation of this regularity that includes the exact initial condition of the earth and its surroundings in the year 4 billion BCE, and the fundamental laws of physics, which deduces therefrom, or at least derives the high probability of, the sequence of particular births that make Arbuthnot's regularity true. Obviously, no one would get much pleasure or enlightenment from reading through such an explanation, even if they lived long enough to do it. By contrast, R. A. Fisher offered a very different explanation, which goes roughly as follows: In any sexually reproducing population, there is selection pressure in favor of producing more offspring of the sex that is less well-represented at the age off reproductive maturity. Simply put, you are more likely to have lots of grandchildren -- and, so, get your genes propagated -- if your own children belong to the sex that is less-numerous when courtship time comes along. Now, for various reasons, among humans, males are the more vulnerable sex, in the sense that they are more likely to die before reaching reproductive maturity. (I'm not entirely sure why this is, but I am told that the "Jackass" franchise of movies casts some light on the matter.) So, in any large human population in which, on average, people fail to tend to have slightly more sons than daughters, there will be a strong selection pressure in favor of whatever it is about some of us that makes them more likely to have more sons. That is why Arbuthnot's regularity holds.

Now, unlike the fundamental physical explanation, Fisher's explanation is an enjoyable read, and moreover, it helps us to genuinely make sense of the phenomenon. You might think that this is just a matter of our limited cognitive capacities, which cannot take in all the details of the fundamental physical explanation, but many philosophers have offered very persuasive arguments to the contrary (e.g. Fodor, Lange, Kitcher, Roberts, Putnam, others), which I'm not going to go into the details of here now. According to those arguments, Fisher's explanation gives us a kind of insight into why Arbuthnot's regularity held up for so many years that cannot

4. Kitcher 2001, p. 71. See also Kitcher 2012.

be matched in terms of explanatory power by anything we could get from the fundamental-physical derivation, even if we could follow it, because Fisher's explanation picks up on patterns that are not visible at the fundamental-physical level.

Now consider Figure 6, which illustrates this case. There is a vast mosaic of particular, fundamental-physical events. There are also certain higher-order patterns, namely the basic principles of Darwinian selection. Those principles are not logical truths: There are improbable but physically possible courses of events in which they are violated all the time, just as there are improbable but physically possible courses of events in which the laws of thermodynamics are violated all the time. So what makes those principles true in the actual world is the contingent way that the fundamental physical facts happen to go -- in other words, the details of how the great mosaic is laid out. So in virtue of these details, certain general principles of evolution are true, in virtue of which we can make good sense of a certain phenomenon, namely Arbuthnot's regularity, which we cannot make sense of by appealing to the fundamental physical facts. But the principles of evolutionary biology do help us to make sense of phenomena like Arbuthnot's regularity, and they do so better than fundamental-physical explanations ever could. (People disagree about why this is so; but almost everyone except for Alex Rosenberg seems to agree that it is so.) So the situation here is a direct counterexample to Premise 2, the principle that explanation transfers though the in-virtue-of relation (and is illustrated by Figure 4).

Again, to explain something is to make sense of it. One way to make sense of it is to show how it was caused. I agree that if Y shows how Z was caused, and Y is true in virtue of X, then X does an equally good job of showing how Z was caused, so it must be just as capable of explaining Z as Y is. But a different way of making sense of something is showing how it fits into a pattern of a certain sort. As the Arbuthnot case shows, information that does help you

situate a phenomenon within a pattern of a certain sort, might be true in virtue of information

which fails to help you situate it within a pattern of that sort. For that reason, I believe that

Premise 2 is not true in general, and in particular, it fails in the case of covering-law explanation.

This shows, surprisingly, that covering-law explanations work very differently from the way

causal explanations do.

9. Mosaics Redux. I think it's worthwhile thinking about one more sort of case in which

explanatory power fails to pass across the in-virtue-of relation. (Here I am venturing into the

area of aesthetics, which I know nothing about, so I apologize to any aesthetics experts in the

audience who know that I am being crude and simplistic, and heartily invite them to set me

straight during the Q&A.) Sometimes we can explain why one element of a work of art is the

way it is by appealing to a larger pattern within that work of art, of which the element itself is a

component. For example, consider Figure 7. This is a mosaic - or rather, it's a picture of a

mosaic.   Notice that the stone indicated by the arrow is brown. Suppose someone asks why the

stone at that particular position in the mosaic is brown. What's the answer?   Here is one

perfectly good answer: "That stone is brown, you see, because this is a portrait of Marc Lange,

in the middle of having a brilliant idea, and see these stones are his eyes and his glasses and his

mouth, so all these stones down here have to be the beard, and therefore they must all be brown."

That's a perfectly good answer to the question. But notice that it explains why this particular

stone is brown by appealing to a general feature of the whole mosaic -- namely that it is a portrait

of Marc Lange. And what makes this a portrait of Marc Lange is, at least in part, the overall

pattern in the arrangement of the stones. Thus, we can make sense of a particular element in this

mosaic by appeal to a general feature of the mosaic, which holds partly in virtue of this element itself. That presents us with a direct counterexample to Premise 2 of the threatening argument.

You might object that in an example like this, what's really happening is that we are explaining the placement of the stone by appeal to the prior psychological state of the artist. She intended to make a portrait of Marc, and given that this intention, and given where she had already placed a lot of the other stones, she could see that she had to place a brown stone here in order to carry out her intention. So this is really just a causal explanation, and as such it poses no challenge to premise 2, or to the principle that explanatory power transfers cross the in-virtue-of relation.

In reply to this, I agree, that you can explain why that particular stone is brown in that way; that is one way of making sense of the placement of a brown stone there, a way that appeals to the intentions of the artist. But that's not the only way of making sense of an element in a work of art. There is such a thing, I am told, as aesthetic understanding of a work of art, which involves understanding the placement and arrangement of its elements in terms of something like an internal logic of the work of art. Such an aesthetic explanation need not make any reference at all to the intentions of the artist. In fact, I gather there's a name for the mistaken idea that aesthetic understanding of a work of art has to make reference to the intentions of the artist -- "the Intentional Fallacy." Aesthetic explanations of this sort, I submit, flagrantly violate the principle that explanatory power transfers across the in-virtue-of relation. The fact that this mosaic is a portrait of Marc helps us make sense of why the indicated stone is brown, and the fact that this mosaic is a portrait of Marc is true partly in virtue of the fact that the indicated stone is brown, but the fact that indicated stone is brown has no power to help us make sense of why the indicated stone is brown.

If my suggestion here is right, then there is an important similarity between covering law explanations and certain sorts of aesthetic explanation. We can for example <u>make sense</u> of why a certain piece of music ends with a C-major triad, by pointing out that the piece is a classical sonata in the key of C major, and that's what happens in classical sonatas in C major. Just so, we can <u>make sense</u> of why Halley's comet returned when it did by pointing out that this system of bodies around us is a Newtonian system, and that's what happens in Newtonian systems. This analogy between covering-law explanations and aesthetic explanations should, I would think, be especially appealing to philosophers inclined to be Humeans about laws anyway. And it might be just what they need to overcome the threatening argument.

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