Replies to Sullivan and Lange

I am greatly indebted to Meghan Sullivan and Marc Lange for their incisive and insightful comments. I will respond to their contributions separately.

Reply to Sullivan

Sullivan argues that neither my assumptions about non-causal explanation nor the full explanatory criterion of relevance (ECR) are needed to account for the modal data I consider in *MER*. Moreover, she aims to show that the conception of explanation on which my theory rests has no basis in ordinary non-philosophical thinking (as I claim it does). I will consider these points in turn.

The explanatory criterion of relevance. The ordering of (possible and impossible) worlds by their closeness to actuality is determined by weighing the different similarities they have to actuality. The similarities to actuality that can make a world closer include resemblances in matters of particular fact. (A matter of particular fact is a fact about the history of the universe that is not entailed by the laws or the truths about what the laws are (*MER*: 180).) They also include the conformity of another world *w* to the natural and metaphysical laws of actuality, such as the fact that nothing at *w* moves faster than light, or that all atoms at *w* that have atomic number 79 are gold atoms. And they include other similarities as well. However, I hold that any such similarity carries weight only if it meets the condition laid down by the *explanatory criterion of relevance*. Simplifying somewhat, we can state this criterion as follows:

(ECR) If some fact *f* obtains both at the actual world and at world *w*, then this similarity is relevant to the closeness ordering iff every fact *g* that partly explains *f* at the actual world obtains at *w*. (*MER*: 211)

The facts that partially explain *f* at the actual world include all causes of *f*, but they may also include some facts that aren't causes, such as grounds of *f*, or certain facts about the laws that partly explain *f*. Sullivan suggests that we should replace ECR with the "causal criterion of relevance" that I briefly consider but ultimately reject in section 8.3. Roughly speaking, this criterion tells us the following:

(CCR) If some matter of particular fact *f* obtains both at the actual world and at another world *w*, then that's a closeness-relevant similarity iff all actual causes of *f* obtain at *w*.

In *MER* I present a variety of data that cannot be explained by CCR, including those involving the examples MAGICIAN ARTIST, GRAVITATION and GOLD ATOMHOOD that Sullivan describes. I argue that ECR affords a simple and unified explanation of these data as well as of the data that could be used to motivate CCR. Sullivan disagrees with my treatment of the three examples mentioned. Let us consider them in turn.

MAGICIAN ARTIST. I should start with some clarifications about this example. m_1 is not a *process* but a certain *scenario*, namely that of block A's being in location L_A at midnight, B's being in location L_B, etc. m_2 and m_3 are two other scenarios—two other patterns of locations of the individual blocks. The answer to Sullivan's question what distinguishes m_1–m_3 is that they involve the individual blocks' being in different locations at midnight. The fact that m_1 is realized (that the blocks are arranged in the m_1-way) is a complex fact about how the individual blocks are distributed over the floor at midnight that is a product of the artist's spell. The fact that the blocks form a *square* at midnight is simply another fact about their spatial distribution at midnight. It's just a less specific fact (at least in some respects) than the fact that the blocks are arranged in the m_1-way. (There are other combinations of locations of the individual blocks that would amount to a square configuration, for example m_2.) The fact the blocks form a square is grounded in, and hence non-causally explained by, the specific positions of the individual blocks. At the actual world, for example, it is grounded in the fact that the blocks are arranged in the m_1-way. The fact that the blocks form a square at midnight obtains at an antecedent-world where the blocks are arranged in the m_2-way, but not at an antecedent-world where they are arranged in the m_3-way. Yet, this extra similarity of the m_2-world does not make that world closer to actuality than the m_3-world is, as is shown by falsity of the counterfactual that Sullivan calls "(B)". CCR cannot explain this fact: Since all factors that are actual causes of the blocks' forming a square at midnight obtain before midnight, and since the closest m_2-worlds are like actuality until midnight, all these factors obtain at the closest m_2-worlds as well. CCR predicts that the fact that the blocks form a square at midnight is a closeness-relevant similarity between the closest m_2-worlds and actuality. By contrast, ECR predicts that the similarity is irrelevant, since one of the actual non-causal explainers of the blocks' forming a square at midnight (viz., their being arranged in the m_1-way) is absent at the closest m_2-worlds.

In section 2 of her comments, Sullivan proposes an alternative explanation of MAGICIAN ARTIST that doesn't rely on ECR. Instead, it uses a new "locality" principle: if a particular fact f obtains both at w and at the actual world, then that is a closeness-relevant similarity only if f "include[s] a description of the local matters of particular fact." The locality principle is supposed to supplement rather than replace CCR, since CCR is still needed to account for other cases, such as the lottery example described in section 1 of Sullivan's comments. On the new account, the presence at w of an actual particular fact f constitutes a closeness-relevant similarity between w and actuality iff f meets the locality conditions *and* all of f's actual causes obtain at w. Sullivan suggests that the data about MAGICIAN ARTIST can be explained by saying that the fact that the blocks form a square doesn't meet the locality condition, so that the fact that they also form a square at m_2-worlds is not a closeness-relevant similarity between these worlds and actuality. I am not sure whether or not this explanation works. (I think I would need to know more about how to understand the locality condition in order to form a judgment.) But even if the explanation works, it lacks the feature that made ECR attractive: the view Sullivan proposes doesn't give a *unified* account of the different data presented in *MER*. Some of them (e.g., the lottery example) are explained by appeal to the causal condition of relevance laid down in CCR, while others like MAGICIAN ARTIST are explained by appeal to the locality condition. By contrast, my account can explain all the data by a single principle (ECR), unsupplemented by a locality condition or any other resources.

GRAVITATION and GOLD ATOMHOOD. I think that GRAVITATION is false, and I argue that this datum is inexplicable by CCR. Sullivan represents my argument as follows. There is some world w where the law of gravitation (which I'll call "G") is not a law of nature, but where all massive objects behave the way they actually do and where all actual causes of their behavior are present. By CCR, the resemblance in their behavior is a closeness-relevant similarity in matters of particular fact between *w* and actuality. So, CCR entails that worlds like *w* are closer than other antecedent-worlds. But that entails that GRAVITATION is true. As Sullivan points out, Humeans about the laws may reject this argument. They believe that what the natural laws are supervenes on facts about the course of history, and they may deny that there are any possible antecedent-worlds where the behavior of all massive objects is like at the actual world.

The argument in *MER* for thinking that the falsity of GRAVITATION cannot be explained by CCR isn't quite the one described by Sullivan, however. My argument doesn't assume that there are antecedent-worlds where all massive objects behave the way they actually do. It merely assumes that there is an antecedent-world *w** where all massive objects conform to *G* (no matter how different their behavior may otherwise be from that of the massive objects at the actual world). Even a Humean should accept that such a world exists.[1] Moreover, my reasoning doesn't focus on similarities in matters of particular fact between *w** and actuality, but on the fact that history conforms to *G* at *w**. The falsity of GRAVITATION shows that *w**'s conformity to *G* doesn't make *w** closer than antecedent-worlds that don't conform to *G*. I don't claim that that finding is inconsistent with CCR. I merely hold that CCR cannot explain the datum, since the scope of CCR is restricted to similarities in matters of particular fact (CCR tells us nothing about the conditions under which *w**'s conformity to the actual laws is relevant to *w**'s position in the closeness ordering). By contrast, ECR explains the finding when it is combined with my background assumptions about explanation: The fact that all massive bodies conform to *G* is actually explained by the fact that *G* is law. Since the latter fact doesn't obtain at *w**, the fact that massive bodies at *w** conform to *G* doesn't meet the condition for closeness-relevance laid down ECR.

[1] Two examples that illustrate this: (i) Consider a possible world *w* where there are no massive objects, so that it's vacuously true that all massive objects conform to *G*. Even by Humean lights, *G* may fail to be a law at *w*, in which case the antecedent of GRAVITATION is true at *w*. (ii) Consider a world *w** with only a small number of massive objects, and assume that all of them conform to *G*. Suppose further that the Humean adopts a Lewisian best-systems account of lawhood (Lewis 1973a). At *w**, adding an axiom that entails *G* to a deductive system complicates the system and adds little deductive strength (given the small number of massive objects at *w**). So, the best deductive system might not have such an axiom, in which case the antecedent of GRAVITATION is true at *w**.

I take the falsity of GRAVITATION to illustrate that conformity to an actual law of nature *P* doesn't make another world *u* closer to actuality unless *P* is also a natural law at *u*. The falsity of GOLD ATOMHOOD supports the claim that something similar is true of the *metaphysical* laws. I analyze

(1) What it is to be a gold atom is to be an atom with atomic number 79

as

(2) It's an essential truth about gold atomhood that all and only atoms with atomic number 79 are gold atoms.

(*MER*: 157) Since essential truths are a form of metaphysical law, (2) in effect tells us that the following generalization is a certain kind of metaphysical law:

(3) All and only atoms with atomic number 79 are gold atoms.

The falsity of GOLD ATOMHOOD suggests that a world *u*'s conformity to the actual essential truth (3) doesn't make *u* closer to actuality unless (3) is also an essential truth at *u*. ECR explains this fact in the same way it explains GRAVITATION. For any essential truth *P*, the fact that everything conforms to *P* is actually explained by the fact that *P* is an essential truth. (This is a special case of the "governing conception" of laws.) For example, the fact stated by (1) actually explains the fact that everything conforms to (3). It follows by ECR that, of the worlds where (1) is false, those that conform to (3) aren't closer to actuality than those that don't conform to (3).

Sullivan says she "doubt[s] that we have clear intuitions about how [GRAVITATION and GOLD ATOMHOOD] should be evaluated." As far as GRAVITATION is concerned, my own experience gives us little reason for such doubt. I have discussed GRAVITATION and similar examples with many philosophers and have encountered almost no one who wasn't strongly inclined to regard these counterfactuals as false. Admittedly, I have not tried out GOLD ATOMHOOD on as many people, but to me it seems to be nearly as obviously false as GRAVITATION. Sullivan herself seems to concede (in the last sentence of section 2) that the two counterfactuals have false readings.

Sullivan suggests that we shouldn't account for the truth-conditions of counterfactuals like GRAVITATION and GOLD ATOMHOOD within the framework of the closeness account at all. Instead, we can settle their truth-values simply by reflecting on "whether it is analytic that only laws govern and only essences account for de re modal connections." However, it is not clear to me that we can settle the truth-values of the counterfactuals in this way. Focus on GRAVITATION first, and suppose we accept that

(4) It is analytic that only laws govern.

(4) is consistent with the existence of an antecedent-world *w* where all massive bodies conform to *G* (even if their conformity to *G* is governed by nothing). (4) doesn't settle whether *w* is closer to actuality than antecedent-worlds that don't conform to *G*, and therefore doesn't determine the truth-value of GRAVITATION. Consider GOLD ATOMHOOD next. In this example, every world where the antecedent holds is metaphysically impossible. The question is whether the consequent is true at the closest of these impossible antecedent-worlds. Now suppose we hold that

(5) It is analytic that only essences account for de re modal truths.

(5) is consistent with the existence of antecedent-worlds where (3) is true. For example, there are antecedent-worlds where gold atomhood exists without being instantiated and where there are no atoms with atomic number 79, and at such worlds (3) is vacuously true. There are also antecedent-worlds where (3) is consistent with the essential truths about gold atomhood (without itself being among these essential truth), and where (3) is a non-vacuous contingent truth. (5) doesn't settle whether these worlds are closer than antecedent-worlds that don't conform to the actual law (3), and therefore doesn't determine the truth-value of GOLD ATOMHOOD.

Absolutism about explanation. In my discussion of the function of modal thought in chapters 10–12, I assume that ordinary reasoning and discourse is open to an idealizing rational reconstruction on which it involves a notion of explanation whose extension is largely independent of the conversational context. Sullivan calls this thesis "absolutism." She aims to cast doubt on absolutism in general, and also presents a separate argument against absolutism about a specific form of non-causal explanation that involves the essential truths. I will discuss her two lines of reasoning in turn.

Sullivan's main reason to reject absolutism about the everyday notion of explanation is that in ordinary discourse it depends heavily on the context how we would answer the question what explains a given fact (even if we focus exclusively on an ontic, non-epistemic reading of "explains"). For example, it depends on the occasion whether we would answer the question "Why are grasshoppers green?" by telling an evolutionary story, by talking about the pigments in the grasshoppers' surface tissue, or by saying, "They look green to normal observer under standard conditions and that's what it is to be green." (*MER*: section 9.1.4) However, I take it to be a demand of good methodology that we should try to explain the messy appropriateness conditions of explanation claims by comparatively simple truth-conditions combined with general pragmatic principles that enjoy independent support. For this will make our overall theory simpler and more systematic. I adopt such an approach in *MER*: sct. 9.1.4. On my account, the reason why an evolutionary answer to the question about grasshoppers is fitting in a conversation about insect evolution but not in a class on insect physiology is not that the answer is *false* in second context. (After all, the *negation* of the evolutionary answer would sound wrong in the physiology classroom as well.) The problem is rather that the answer doesn't address the interests and informational needs of those taking the physiology class. Adapting an idea by Peter Railton (1981) and David Lewis (1986), I hold that there is a single complete account of what explains the fact that grasshoppers are green that is true across contexts (if we ignore some minor forms of context dependence that admittedly exist (*MER*: sct. 9.1.3)). This account includes a description of the evolutionary processes that led to the spread of greenness genes in the gene pool, of the way these genes lead to the production of pigments, of how these pigments cause greenness sensations in normal observers under standard conditions, and of much else besides. (The complete account has to trace the explanatory chain all the way back to the Big Bang.) It's true to say of any part of this explanatory history that it partly explains the fact that grasshoppers are green. However, in any given context where the question arises, the participants in the conversation are only interested in a few parts or aspects of the complete story, and an answer is fitting only if it addresses these interests. Since the interests vary widely across contexts, so do the standards of fittingness for explanatory claims. This is the same type of account we would give for many other cases of context-sensitive idioms. To borrow an example from Lewis (1986: 229), it varies widely across contexts what the fitting answer is to "What's going on here?", even if we hold fixed which spatio-temporal region is in question. But that's not because it depends on the context whether a given event can be truly described as occurring in that region. There is a complete story about what is happening in that region that is true across contexts. But only a tiny fraction of that story is of interest in any given context, and it varies from one context to the next which part is relevant.

Absolutism about explanation by essence facts. On my account, the fact that *what it is to be an F is to meet condition C* explains the fact that *all F's meet condition C*. For example, the fact that

(6) What it is to be a helium atom is to be an atom with atomic number 2

explains the fact that

(7) All helium atoms have atomic number 2.

According to Sullivan, it is part of my view that

(8) (6) closes the question why (7) holds.

She goes on to argue that, given my absolutism about explanation, it follows from my view that (6) counts as closing the question why (7) holds *in all contexts*. Sullivan aims to show that this consequence is false: in the conversational context that prevails in her example PROTON MANUFACTURING, (6) does not close the question why (7) holds.

The expression "close the question" is not used in *MER*, and I am not completely sure how to interpret it. I will consider the three most salient ways of understanding the phrase as used in (8).

Firstly, "closes the question" could mean "correctly answers the question," so that (8) amounts to the following claim:

(9) The fact stated by (6) explains the fact stated by (7).

I endorse (9), and I don't think PROTON MANUFACTURING shows that (9) is false. The most that the example could show is that in its conversational context the fact stated by (7) is explained by certain facts about the early universe. (I will raise doubts below about whether the example really shows this, but let's assume for the moment that it does.) That explanatory claim is perfectly consistent with the claim that (9) is true in the context as well. After all, it could be that the fact stated by (7) has more than one explanation. In fact, the character of Carrie in PROTON MANUFACTURING seems to agree with Beatrice's assertion that (9) holds, so I assume that Sullivan herself agrees that (9) is true in the context of the example.

Secondly, (8) could be understood as the conjunction of (9) with the following claim:

(10) The fact stated by (6) is not explained by anything.

I accept (10) as well. And again, it seems that PROTON MANUFACTURING doesn't show that (10) is false. Carrie offers an explanation of the fact stated by (7) but not of the fact stated by (6), and there is no reason to think that anything counts as an explanation of the fact stated by (6) in the context of the example.

Thirdly, (8) could be interpreted as the claim that

(11) (6) leaves no question open about why (7) holds: it tells us everything there is to know about the matter.

MER doesn't say whether (11) is true. But I find it plausible that there is a sense in which (11) *is* true: nothing except the fact stated by (6) explains the fact stated by (7). Now, (11) must be false if what Carrie says in PROTON MANUFACTURING is true, since Carrie claims that the fact stated by (7) is explained by the conditions of the early universe. However, I would argue that what Carrie says is false (though what she *means* to say may be true). The facts about the early universe that Carrie describes may explain why only atoms with atomic number 2 came into existence at that time. They may thereby indirectly explain why all atoms that came into existence then were helium atoms (for, their being helium atoms is explained by their being atoms with atomic number 2, together with the fact stated by (6).) But I don't think the conditions of the early universe explain the general fact stated by (7). I cannot argue for this view in detail here, but will merely note that it seems to be supported by the counterfactual dependence relationships that obtain between the relevant facts in the example. If the conditions in the early universe had been very different, it might not have been true that all atoms that formed back then had atomic number 2, or that they were all helium atoms. But it would still have been true (perhaps vacuously) that all helium have atomic number 2. (7) does not counterfactually depend on the conditions of the early universe.

Reply to Lange

Marc Lange's penetrating comments raise more thought-provoking issues than I could adequately address, so I will be forced to be somewhat selective. I should start with two clarifications, before taking on Lange's points one by one.

The *first* clarification is that my account doesn't analyze necessity in counterfactual term. I don't hold that what makes a proposition necessary is that it is a member of a class that satisfies the condition (2.3') cited by Lange. I merely appeal to the connection between necessity and counterfactuals as one of several data that an analysis of necessity should explain, before motivating my own approach as providing an attractive explanation. One of the data is the truth of the following largely uncontroversial principle about metaphysical necessity and possibility:

(1) *P* is necessary iff *P* is true and, for every possible proposition *Q*, *P* would still have been true if *Q* had been true. (*MER*: 24)

I take (1) to be one way of spelling out the standard characterization of the metaphysical necessities as those propositions whose truth is invariable across possible scenarios, i.e. as those propositions that are "true in all possible situations" (cp. Jackson 1998, Chalmers 2002). (The claim that the necessary truths form a class that meets condition (2.3') is merely an alternative way of stating datum (1). Given that *Q* is possible iff *Q*'s negation isn't necessary, we can reformulate (1) by saying that the necessary truths form a class *x* that meets following condition: a proposition *P* is a member of *x* iff *P* is true and for every proposition *Q* whose negation is not in *x*, *P* would still have been true if *Q* had been true. The point of this alternative formulation is to single out the extension of necessity without employing the notions of possibility and necessity. (*MER*: sct. 2.1.3) If we use the closeness account of counterfactuals to unpack the alternative formulation, the result is the claim that the necessary truths form a class that meets condition (2.3').) I also discuss other data about the connection between necessity and counterfactuals, such as the fact that the extension of necessity can be characterized as comprising just those propositions that would have been true no matter what. (Lewis 1973a: sct. 1.5, Williamson 2005, Kment 2006b: sct. 2.1; also cp. Stalnaker 1968: sct. III) Moreover, I think that the counterfactual conditional is just one of many linguistic constructions whose connection to necessity should be explained by a theory of modality. Other examples I discuss in chapter 2 include "it could more easily have been that … than that …," "it nearly happened that," "the peace was fragile," etc. (See the Précis for examples).

On the account I propose to explain these data, the most fundamental notion of possibility is comparative and is analyzed in terms of a closeness ordering of worlds: *P* has a higher degree of possibility than *Q* iff some *P*-world is closer to the actualized world than any *Q*-world. (Lewis 1973a: sct. 2.5, 1973b: sct. 2.1; Kratzer 1991: scts. 3.3 and 5) Comparative *necessity* can be defined accordingly. What makes a proposition metaphysically necessary is that its degree of necessity is above a certain threshold, which is so iff the proposition is true at all worlds within a certain distance from actuality, i.e. at all worlds within a certain sphere around actuality. (To complete this definition, we need to specify *which* sphere is relevant; see principle (5) below.) What makes it the case that *Q* would have been true if *P* had been true is that $\ulcorner P \,\&\, Q \urcorner$ has a higher degree of possibility than $\ulcorner P \,\&\, {\sim}Q \urcorner$, which in turn is due to the fact that some $\ulcorner P \,\&\, Q \urcorner$-world is closer to actuality than any $\ulcorner P \,\&\, {\sim}Q \urcorner$-world. Chapters 2 and 3 describe how this theory accounts for the aforementioned data. What explains the connection described by (1) between metaphysical modality and counterfactuals isn't that metaphysical modality is defined in terms of the counterfactual conditional or vice versa, but that both are defined in terms of comparative possibility. (*MER*: 43) The proposed reduction of modality to the non-modal doesn't reside in these inter-definitions of different modal properties and idioms, but in the definition of comparative possibility in terms of comparative closeness between worlds.

The *second* clarification is that I don't think it's generally true that the laws have high degree of necessity. The metaphysical laws do, but I don't hold that the same is true of the natural laws. I didn't have tea this morning. Under determinism, any world where I have tea and which conforms perfectly to the actual laws must be unlike actuality throughout its pre-antecedent history. If we counted these as the closest tea-drinking worlds, we would face some very implausible consequences (sct. 8.5), in particular if we also accept the explanatory criterion of relevance (ECR). Following David Lewis, I avoid these consequences by holding that (under determinism) the closest antecedent-worlds are like actuality until shortly before the antecedent-time, and then diverge by a small violation of the actual laws of nature so that the antecedent comes out true.[2] Under determinism it's true that if anything whatsoever had been different at the present moment, then some actual law would have been false. So, some laws could very easily have been false, and such laws can have at best a very low degree of necessity. My view goes still further: I hold that a universal generalization can be a law even if there *actually* are a few small exceptions to it. Consequently, some actual laws might be strictly speaking false at the actual world, in which case they cannot have any form of necessity. On the other hand, the truths about what the laws are (e.g. the truth that it's a fundamental natural law that *P*) do have a special form of necessity. I hold that

(2) The worlds that have the same metaphysical laws as actuality and perfectly conform to these metaphysical laws and that also have the same natural laws as actuality (whether or not they perfectly conform to these natural laws) form a sphere around actuality. (*MER*: 187–8)

The actual truths about what the laws are have the grade of necessity corresponding to the sphere specified in (2). I call this grade "nomic necessity."

The thesis that the laws themselves have a special form of necessity might seem tempting in part because of the familiar observation that the laws have a kind of counterfactual-supporting power that is not possessed by accidental generalizations (i.e., by true universal generalizations that aren't consequences of the laws and the truths about what the laws are). Knowledge that, as a matter of accident, all coins in my pocket are quarters should not make me confident that if I had gone shopping this afternoon, I would still have only quarters in my pocket. By contrast, if I know that it's a law that nothing moves faster than light, then that *should* make me confident that if we had much more advanced technologies than we actually do, we still wouldn't be able to travel to the moon at more than the speed of light. I don't believe this difference in counterfactual-supporting power between laws and accidental generalizations reflects a difference in

[2] There might be some exceptions to this claim. See *MER*: 201 n. 6.

degrees of necessity. In order for a law *L* to have a greater degree of necessity than an accidental generalization *G*, the following would have to be true:

(3) There is some sphere *S* around actuality such that

(i) *L* is true at every world in *S*, and

(ii) *G* is false at some world in *S*.

I don't hold that (3) is true for every law *L* and accidental generalization *G*. By contrast, in order for *L* to have greater counterfactual-supporting power than *G* (at least on one reasonable way of measuring that power), all that is required (given other principles for which I argue in *MER*) is that the following be true:

(4) There is some sphere *S* around actuality such that

(i) for every world *w* in *S*, whether events conform to *L* at *w* is relevant to *w*'s degree of closeness to actuality, and

(ii) for some world *w* in *S*, whether events conform to *G* at *w* is not relevant to *w*'s degree of closeness to actuality.

In the next paragraph, I will aim to explain the sense in which (4) underlies the fact that *L* has greater counterfactual-supporting power than *G*. But first, I should briefly explain why (4) is true on my account. The fact that events conform to the law *L* is explained by the fact that *L* is a law. By contrast, the fact that events conform to an accidental generalization *G* (i.e., the fact that *G* is true) is explained in part by certain nomically contingent matters of particular fact *ff*. (For example, the fact that all coins in my pocket are quarters is explained by the fact that each of the coins C_1, C_2, … is a quarter, together with the fact that there are no coins other than C_1, C_2, … in my pocket. The latter fact in turn is partly explained by the fact that I didn't go shopping.) It follows by ECR that the conformity to *L* of events at *w* is a closeness-relevant similarity to actuality iff *L* is a law at *w*. It also follows by ECR that if the events at another world *w* conform to *G*, then that is a closeness-relevant similarity to actuality only if the *ff* obtain at *w*. By (2), the worlds that have the same laws as actuality and conform to the actual metaphysical laws form a sphere S_N around actuality. (S_N is the class of nomically possible worlds.) *L* is a law at every world in S_N. Hence, for any world *w* in S_N, the degree to which *w* conforms to *L* is closeness-relevant. The nomically contingent facts *ff* fail to obtain at some worlds in S_N.

Therefore, for some world *w* in S_N, whether *w* conforms to *G* is not closeness-relevant. That shows that (4) holds.

If a counterfactual has a nomically possible antecedent about particular local facts, then the closest antecedent-worlds are in S_N and their conformity to the actual laws is therefore closeness-relevant. That doesn't mean that these worlds *perfectly* conform to the actual laws, since a world's degree of lawfulness must be weighed against the degree to which it matches actuality in matters of particular fact. As mentioned before, under determinism perfectly lawful antecedent-worlds differ from actuality throughout pre-antecedent history, which makes them less close than antecedent-worlds that diverge from actuality by a small violation of the actual laws shortly before the antecedent-time. The latter antecedent-worlds are therefore the closest. But even these worlds are perfectly lawful except for the small divergence miracle.[3] We can therefore typically assume that, by and large, events would still have conformed to the actual laws of nature if the antecedent had been true. In this sense, the actual laws support counterfactuals with nomically possible antecedents about particular local facts. The same is not true of accidental generalizations. Some of the matters of particular fact that actually explain the truth of such a generalization may fail to obtain at the closest antecedent-worlds, in which case it is irrelevant to the closeness of these worlds whether they conform to the generalization. For example, worlds where I went shopping this afternoon are not closer if it's true at them that all coins currently in my pocket are quarters than if this isn't true at them.

What underlies the difference in counterfactual-supporting power between a natural law *L* and an accidental generalization *G* isn't a modal difference between *L* and *G*. Rather, it's a modal difference between the facts that explain the fact stated by *L* and the facts that explain the fact stated by *G*. The fact stated by *L* is explained by a fact about the natural laws that is nomically necessary, while the fact stated by *G* is explained at least partly by nomically contingent matters of particular fact. It is this difference that accounts for the truth of (4) and hence for the difference in counterfactual-supporting power.

Let me now discuss Lange's comments in turn.

[3] There are some exceptions to this claim. See *MER*: 219.

My account's ability to accommodate (1). Let's say that *P* is "counterfactually implied" by *Q* iff *P* would have been true if *Q* had been true. (1) tells us that that every necessary truth is counterfactually implied by every possible proposition. I hold that that principle is true of every grade of necessity. Lange intends to raise doubts about whether that thesis is consistent with my theory. If I understand his argument correctly, it focuses on nomic necessity. Lange assumes that on my account all laws are nomically necessary, and he questions whether on my account the laws are counterfactually implied by all nomically possible propositions. As it stands, the argument doesn't apply to my view, since I don't in fact hold that the natural laws are nomically necessary. However, I do believe that the *metaphysical* laws are both metaphysically and nomically necessary. So, if my account could be shown to entail that some metaphysical laws aren't counterfactually implied by all metaphysically possible propositions, then my account would indeed entail that there are counterexamples to thesis (1).

What reasons are there for thinking that that is the case? Let *P* be a metaphysical law. Lange points out that *P* is typically not counterfactually implied by the following propositions:

(i) *P* is not a law.

(ii) *P* is not metaphysically necessary.

Consequently, if either of these propositions were metaphysically possible on my account, then my view would yield counterexamples to (1).

However, both (i) and (ii) are metaphysically impossible on my view, so that there is no counterexample to (1) in the neighborhood. I offer a real definition of metaphysical necessity that (to simplify somewhat) runs as follows:

(5) A proposition is metaphysically necessary iff it is true at every world in the sphere of worlds that have the same metaphysical laws as the actualized world and that conform to these metaphysics laws (i.e., where these laws are true). (*MER*: sct. 7.1)

("The actualized world" in (5) is a non-rigid definite description. At any given world *w*, the description picks out the world that is actualized at *w*.) (5) entails the following:

(iii) If *P* is a metaphysical law, then it's metaphysically necessary that *P* is a metaphysical law.

(iv) If *P* is a metaphysical law, then *P* is metaphysically necessary.

Let *P* again be a metaphysical law. We can use (iii) to infer:

(v) Necessarily, *P* is a metaphysical law.

That means that (i) is metaphysically impossible. Now, I hold that (5) is a real definition of metaphysical necessity, and that all real definitions are essential truths (*MER*: 158–159) and therefore metaphysical laws. Given (iv), it follows that

(vi) (5) is metaphysically necessary.

Since (iv) is a consequence of (5), it follows that (iv) must be necessary as well:

(vii) Necessarily, if *P* is a metaphysical law, then *P* is metaphysically necessary.

From (v) and (vii), we get the result that it's necessary that *P* is metaphysically necessary. That entails that (ii) is impossible.[4]

Circularity. Lange suspects that my account entails the existence of circular chains of explanation: the fact that *P* is (metaphysically) necessary partly explains itself. Here it is important to remember that what makes a proposition necessary on my account isn't its membership in a set that satisfies condition (2.3') (as Lange's argument assumes). Rather, what makes a proposition *P* necessary is, roughly speaking, that

[4] As indicated, (5) is a simplified rendering of the real definition of metaphysical necessity offered in *MER*. According to the definition given in *MER* (sct. 7.1), there is an exception to the principle that (i) and (ii) are impossible for every metaphysical law *P*: the principle doesn't hold if *P* is an essential truth about a contingent entity. As an illustration, consider the following truth, which is essential to Fred:

P For all *x*, if *x* is Fred, then *x* originated from sperm *S* and egg *E*.

Like all essential truths, *P* is a metaphysical law. But the fact that *P* is a metaphysical law is not a necessary truth. What's necessary is rather that *if Fred exists*, then *P* is a metaphysical law (*MER*: 185–186). (At a possible world where Fred doesn't exist, no proposition can be essential to Fred. At such a world, *P* is neither an essential truth about Fred nor a metaphysical law.) Similarly, it's not necessary that *P* is necessary. Rather, what's necessary is that *if Fred exists*, then *P* is necessary. In this special case, (i) and (ii) are indeed possible: at a possible world where Fred doesn't exist, *P* fails to be a metaphysical law and also fails to be metaphysically necessary. However, in this special case it's also true that (i) and (ii) counterfactually imply *P*, so that we don't get a counterexample to thesis (1). To see this, note that at every metaphysically possible world where either (i) or (ii) is true, Fred fails to exist, so that *P* is vacuously true. That means that *P* is true at all the closest (i)- and (ii)-worlds.

C *P* is true throughout the sphere of those worlds that have the same metaphysical laws as the actualized world and that conform to these laws (i.e., where these laws are true).

(Metaphysical lawhood is a non-modal property that is more fundamental than metaphysical necessity; see chapter 6.) To say that a world *w* has the same metaphysical laws as actuality is to say that the actual truths about the metaphysical laws (i.e., the actually true propositions of the forms *It's a metaphysical law that P* and *It's not a metaphysical law that P*) are true at *w*. Hence, a proposition *P* meets condition *C* iff *P* is true at every world where all actual metaphysical laws are true and where all actual truths about the metaphysical laws are true as well. Moreover, according to the theory of worlds developed in chapter 4, *P* is true at all worlds where such-and-such propositions hold iff (to simplify somewhat) *P* is a logical consequence of these propositions. (Logical consequence is a non-modal relation explicable in terms of a notion of logical structure of Russellian propositions (*MER*: scts. 1.5, 4.3).) So, a proposition *P* meets condition *C* iff (roughly speaking) *P* is a logical consequence of the actual metaphysical laws and the actual truths about the metaphysical laws. The facts that explain *P*'s meeting condition *C* (and hence *P*'s metaphysical necessity) include facts about what the metaphysical laws are, about what the truths about the metaphysical laws are, and about logical relationships between propositions. But they don't include any facts about which propositions are metaphysically necessary (i.e., any facts statable by propositions of the forms *It's metaphysically necessary that P* and *It's not metaphysically necessary that P*). In particular, they don't include the fact that *P* is metaphysically necessary. So, the fact that *P* is metaphysically necessary doesn't partly explain itself.

Explaining explanatory relationships. I offer a reductive account of modality in terms of explanation. As Lange points out, that means that I cannot account for the fact that *f* explains *g* by appealing to a nomic necessitation relationship between *f* and *g*. My first response is that it doesn't seem clear to me that that is a great loss, since the prospects of a nomic-necessitation account of explanation seem dim anyway. On the account for which I argue in *MER*: sct. 6.2.2, a certain relationship between *f* and *g* can ground *f*'s explaining *g* only if some essential truth about explanation lays down that that relationship is a sufficient condition for *f* to explain *g*. Now, nomic necessitation might be a *necessary* condition for certain kinds of explanatory relationships (such as grounding), but it clearly isn't a sufficient condition. If there is a non-trivial sufficient condition in the vicinity, it would have to be the conjunction of nomic necessitation with some other condition. Unfortunately, attempts to formulate a non-trivial sufficient condition like this have met with little success in the past. But suppose for the sake of the argument that a suitable sufficient condition can be found. Then presumably it is also possible to formulate a suitable sufficient condition in terms of a hyperintensional, non-modal notion of nomic entailment like the one used in *MER* to state the various versions of the determination idea (scts. 6.2.3, 10.4.1). A statement of this sufficient condition will be roughly of the following form (clause (ii) is a placeholder for the part of the theory that remains to be completed):

(6) For any laws L_1, L_2, …, true propositions P_1, P_2, …, and true proposition Q:

> the facts stated by P_1, P_2, … and the fact that L_1, L_2, … are laws together explain the fact stated by Q if (i) P_1, P_2, … and L_1, L_2, … together entail Q and (ii) ____.

(In the limiting case where L_1, L_2, … alone entail the fact stated by Q and condition (ii) is satisfied, the fact that L_1, L_2, … are laws by itself explains the fact stated by Q.) If there is a suitable true principle of this form, I can see no reason that would debar me from saying that this principle is an essential truth about explanation, and to appeal to it to explain various explanatory relationships. (I don't hold that explanation is more fundamental than lawhood and therefore have no reason to deny that lawhood can figure in the essence of explanation.) In particular, it might be possible to use the principle to answer Lange's question of how to account for the fact that *P*'s lawhood explains the fact stated by *P*. Suppose it's a law that all *F*'s are *G*. This laws entails itself. Hence, provided condition (ii) is satisfied, the fact that it's a law that all *F*'s are *G* satisfies the sufficient condition determined by (6) for explaining the fact that all *F*'s are *G*.[5] That explains why the former fact explains the latter.

[5] Of course, it's hard to say whether condition (ii) is satisfied in the case at hand without knowing what condition (ii) is. So, it's hard to say whether an account of the kind I just outlined can work. But we face the same problem if we wanted to use the nomic-necessitation account of explanation to account for the fact that *P*'s lawhood explains the fact stated by *P*. For such an account to work, the fact that *P* is a law needs to satisfy the sufficient condition for explaining the fact stated by *P* that is determined by the correct

The account I just gave assumes that there are no exceptions to the law under consideration. If there are exceptions, then it's not a fact that all *F*'s are *G*, so there is no question about what explains that fact. However, I claim that even in that case, the fact that it's a law that all *F*'s are *G* explains the fact stated by the footnoted variant of the law. (*MER*: 161 n. 21) The footnoted variant is the proposition *All F's other than … are G*, where "…" specifies all actual exceptions to the law. (*MER*: 161 n. 21, *MER*: 275–6) The law entails its footnoted variant. Hence, provided condition (ii) is satisfied, the fact that it's a law that all *F*'s are *G* satisfies the sufficient condition determined by (6) for explaining the fact stated by the footnoted variant of the law. That explains why the former fact explains the latter.

Explaining explanatory asymmetries. Facts about what the laws are (FLs) have a higher grade of necessity than matters of particular fact (MoPFs). In *MER* (sct. 11.3.3) I use ECR and some background assumptions to argue that this modal difference between FLs and MoPFs is explained by the following explanatory asymmetry: FLs often explain MoPFs but MoPFs never explain FLs (sct. 6.4.4). As Lange points out, while this theory explains the modal difference, it doesn't account for the explanatory asymmetry that underlies the modal difference. He takes this to be a reason to opt for the converse order of explanation: MoPFs cannot explain FLs because the former have a lower grade of necessity than the latter, and because

(7) A fact *f* cannot explain another fact that has a higher grade of necessity than *f*.

My response is threefold. *Firstly*, principle (7) doesn't seem correct to me. Consider the disjunctive fact that either it's a law that nothing moves faster than light or Obama is president. This fact is nomically necessary because its first disjunct is nomically necessary. Moreover, it seems plausible that a disjunctive fact is grounded in each disjunct that obtains (*MER*: 167, Correia 2010: sct. 6, Rosen 2010: 117, Fine 2012: sct. 7). Hence, the disjunctive fact under consideration is grounded in the fact that it's a law that nothing moves faster than light, and it's also separately grounded in the fact that Obama is president (it's a case of explanatory over-determination). So, the fact that

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version of the nomic-necessitation account. And it's hard to say whether it *will* satisfy this condition, since we don't know what the correct nomic-necessitation account looks like.

Obama is president explains the disjunctive fact, despite having a lower grade of necessity than the disjunctive fact. That looks like a counterexample to (7). *Secondly*, even if (7) were true and we could appeal to (7) to account for the explanatory asymmetry between FLs and MoPFs, I am not sure that that would be a great advance. Just as my theory fails to explain the explanatory asymmetry between FLs and MoPFs, the alternative account as it stands fails to explain their difference in degree of necessity. The alternative account also leaves it unexplained why (7) holds, i.e. why facts with a lower grade of necessity cannot explain facts with a higher grade. The "modal conception" of explanation mentioned by Lange may tell us that nomic necessitation is a necessary condition for explanation, but that neither entails nor explains the fact stated by (7). After all, a fact *f* can nomically necessitate another fact that has a higher grade of necessity than *f*. (In fact, on my account every MoPF nomically necessitates every FL, since every FL is nomically necessary.) Someone could try to motivate (7) by the assumption that counterfactual dependence is a necessary condition for an explanatory relationship. That assumption does entail (7), since a fact with a higher grade of necessity cannot counterfactually depend on a fact with a lower grade. But the assumption is false—it's well-known that counterfactual dependence is *not* necessary for explanation. *Thirdly*, for reasons given in chapters 8 and 11, I think that numerous other modal differences between facts can be explained by explanatory dependencies and asymmetries together with ECR (see the paragraph in the Précis about the explanatory power of ECR). If we account for the explanatory asymmetry between FLs and MoPFs in terms of their modal difference, we go against the direction of explanation that prevails in these other cases. By contrast, my explanation conforms to the pattern that prevails in the other cases and therefore yields a more unified overall account.

Lange also describes a second strategy for explaining the explanatory asymmetry between MoPFs and follows (my emphasis):

> Intuitively, the reason for the explanatory asymmetry is that if <u>*Q* is responsible for *P*'s metaphysical necessity</u>, then *Q* is responsible for *P*'s holding in all metaphysically possible worlds; and so <u>in any metaphysically possible world, *Q* is responsible there for *P*'s holding</u>; and hence *Q* holds in any metaphysically possible world; and so *Q* is metaphysically necessary.

The second underlined passage is equivalent to the claim that *Q* necessarily explains the fact stated by *P*. When drawing the inference from the first underlined passage to the second underlined passage, Lange seems to use the following principle as an implicit premise:

(8) If certain facts explain the necessity of a proposition *P*, then these facts necessarily explain the fact stated by *P*.

This principle, which is crucial to the proposed explanation, doesn't seem correct to me. I argue in section *MER*: 6.3.2 that some facts about the metaphysical laws aren't explained by anything. A plausible example is

(9) the fact that it's essential to the property of being a gold atom that something is a gold atom iff it is an atom with atomic number 79.

Like all facts about what the metaphysical laws are, (9) is necessary. Moreover, (9)'s necessity is explained by (9)'s being a fact about the metaphysical laws (together with certain facts about what it is to be necessary and possibly other facts). But (9)'s being a fact about the metaphysical laws doesn't explain (9)—by hypothesis, *nothing* explains (9). A fortiori, (9)'s being a fact about the metaphysical laws doesn't *necessarily* explain (9). That looks like a counterexample to (8).

The S4 principle.[6] My account of necessity relies on an ordering of pairs of worlds by their degree of mutual closeness. For any degree *d* of closeness that can hold between two worlds, there is a relation of two worlds' having *at least* degree *d* of closeness to each other. I call that relation the *grade* of closeness corresponding to the *degree* of closeness *d*. The worlds that have a given grade of closeness to the actual world form a sphere around the actual world. To each grade of closeness *g* corresponds a certain grade of necessity; a proposition *P* has that grade of necessity iff *P* is true at every world that has grade of closeness *g* to actuality. Some grades of closeness are non-transitive; such a grade of closeness may hold between worlds *w** and *w* and between *w* and the actual world without holding between *w** and the actual world. The non-transitivity of a grade

[6] For the sake of simplicity, my discussion of the S4 principle below will ignore some complications that arise from my thesis that many worlds are contingent existents (*MER*: sct. 4.5). *MER*: sct. 4.7–4.8 discusses the implications of this thesis for the S4 principle and for related issues.

of closeness can generate counterexamples to the S4 principle for the corresponding grade of necessity.[7] However, I hold that there are also grades of closeness that are transitive. Consequently, counterexamples to the S4 principle that are generated by failures of transitivity arise for some grades of necessity but not for others. Lange asks what explains this difference.

To answer this question, I need to back up a little. The ordering of pairs of worlds by their degree of mutual closeness is determined by list of criteria that are ranked by importance. The ordering is what we may call "lexical," i.e. lower-ranked criteria are used solely to break ties between pairs of worlds that are equally similar by more highly ranked criteria (the lower-ranked criteria are otherwise irrelevant). Thus, if w_1 and w_2 are more similar to each other than w_3 and w_4 by the most highly-ranked criterion, then w_1 and w_2 automatically count as being closer to each other overall than w_3 and w_4, regardless of how the two pairs of worlds compare by the other criteria. If the two pairs are equally similar by the first criterion, we move on to the second criterion. If one pair is more similar by the second criterion, then it is closer. If the two pairs are tied again, we move on to the third criterion. And so on. (*MER*: 219–220) Lexical closeness orderings often generate some grades of closeness that are transitive and others that are not. Consider a lexical ordering of English four-letter words by their alphabetic closeness. The weightiest criterion is the alphabetic distance of their first letters (which is zero if the first letters are the same, one if they are alphabetically adjacent, etc.). The second-weightiest criterion is the alphabetical distance of their second letters. And so forth. There is a grade of alphabetic closeness that attaches to just those pairs of words that start with the same letter (such pairs are closer overall than pairs that don't start with the same letter). This grade of closeness is transitive: if w^{**} and w^* start with the same letter, and if w^* and w also start with the same letter, then so do w^{**} and w. Another grade of alphabetic closeness holds between two words iff the alphabetic distance between their first letters is no greater than one. That grade is not transitive: "kite" and "loud" have that

[7] Suppose that grade of closeness c holds between w^{**} and w^* and also between w^* and actuality, but not between w^{**} and actuality. Let P be a proposition that holds at every world that has c to actuality, but not at w^{**}. Then P actually has the grade of necessity, N, that corresponds to c. But P doesn't have N at w^*, since there is a world (viz., w^{**}) that has c to w^* and where P is not true. Hence, the proposition that P has N is not true at all worlds that have c to actuality, and that proposition therefore doesn't actually have N. So, P actually has N, but the proposition that P has N doesn't actually have N. The S4 principle is therefore not true of N.

grade of closeness to each other, and so do “loud” and “mite,” but “kite” and “mite” do not. More generally, if a grade of alphabetic closeness attaches to just those pairs of words whose first *n* letters are the same (where $0 \leq n \leq 4$), then it is transitive. Many other grades are not transitive.

Mutatis mutandis, the same is true of grades of closeness between worlds. Some of them apply to just those pairs of worlds that are perfectly similar by the *n* most important criteria. These include the grade of closeness corresponding to metaphysical necessity, which holds between just those worlds that are perfectly similar by the weightiest criterion (match in metaphysical laws and conformity to these laws). They also include the grade corresponding to nomic necessity, which holds between just those worlds that are perfectly similar by the weightiest criterion *and* by the second-weightiest one (match in the natural laws). These grades of closeness are transitive, so that there are no transitivity-related counterexamples to the S4-principles for metaphysical and nomic necessity. However, there are such counterexamples for many other grades of necessity. That is illustrated by the example of Fred’s losing the match (which is cited by Lange). Imagine a scenario where Fred loses the match due to a combination of bad luck during the game and lack of exercise beforehand. The closest world where Fred wins differs from actuality in both of these factors and thereby departs too much from actuality to count as possible in the context. However, a world that differs from actuality in just one of the two factors is close enough to actuality to count as possible. For example, the closest world where Fred exercises regularly (call it “*w*”) counts as possible. At *w*, Fred still suffers from bad luck during the game and therefore loses, but some worlds where he exercises *and* has good luck are so close to *w* that they count as being possible at *w*. So, if Fred had exercised regularly before the match, he still wouldn’t have won, but it would have been true to say that he *could* have won. Hence, at the actual world his winning is not possible, but it’s possibly possible. That shows that the grade of modality under discussion in this context violates the S4 principle.

Counterexamples to the counterfactual test. What I call the “counterfactual test” for explanatory connections is the following inference rule (*MER*: 294):

(CT*) *Q* counterfactually depends on *P*.

Therefore, the fact stated by *P* partly explains the fact stated by *Q*.

(A proposition *Q* counterfactually depends on another proposition *P* iff *P* and *Q* are true and *Q* wouldn't have been true if *P* hadn't been true.) CT* is restricted to cases where *P* and *Q* are different propositions and *P* states either certain matters of particular fact (MoPF), or a fact about the metaphysical laws (FML), or a fact about what the fundamental natural laws are (FNL) (i.e., the fact that such-and-such is a fundamental natural law or the fact that such-and-such is not a fundamental natural law).[8] A fundamental natural law is a natural law whose lawhood is not explained by the lawhood of another principle. (*MER*: 162) (There are some restrictions on *Q* as well (*MER*: 294), but we can ignore these for present purposes.)

As Lange mentions, I take this inference rule to be defeasible. The counterexamples to CT* follow a pattern that I describe in section 12.1. (The list of cases on pp. 318–319 is intended to illustrate this pattern but isn't meant to provide an exhaustive taxonomy of instances.) Despite these counterexamples, I think there is little risk in practice that applications of CT* will generate false beliefs about explanation. Not only is CT* pretty reliable despite the existence of some counterexamples. (As Lange mentions, I hold that the principles that define the standard closeness relation are designed to maximize the reliability of CT*). In addition, as discussed in sections 12.1 and 12.2, our method of establishing explanatory claims by counterfactual reasoning often involves more than showing that *E* counterfactually depends on *A* and then mechanically applying CT* to infer that *A* partly explains *E*. After showing that *E* counterfactually depends on *A*, we need to choose between two possible accounts of why this counterfactual dependence holds. One account entails that *A* partly explains *E*, while the other instead explains the counterfactual dependence as an instance of the pattern described in section 12.1. We should apply CT* only if we decide that the first account is the better one. Fortunately, this inference to the best explanation typically requires little or no additional conscious effort, since the reasoning by which we established the counterfactual dependence already revealed everything we need to know about why that dependence holds. (*MER*: 309)

[8] See *MER*: 294. The formulation of CT* given there is restricted to cases where *P* states either a MoPF or a fact about the (metaphysical or natural) laws, where a fact about the natural laws is defined as a fact about which principles are and which aren't fundamental laws of nature (*MER*: 180).

The aforementioned restrictions on CT* (like the principles governing modal thinking more generally) are tailored to maximize the reliability of CT*. They rule out applications of the inference rule that would otherwise be counterexamples, including, as far as I can see, the cases described by Lange. His *special-relativity example* involves two logically equivalent laws, P and Q, where the lawhood of P explains the lawhood of Q but not vice versa. Since P and Q are logically equivalent,

(10) P counterfactually depends on Q.

But the fact stated by Q doesn't partly explain the fact stated by P. This doesn't seem to be a counterexample to the inference rule CT* as stated above. Since Q states neither a MoPF nor an FML nor an FNL, CT* cannot be applied to (10). Lange's *Coulomb's-law example* involves Coulomb's law, C, and two restricted versions of C, P_1 and P_2, whose scopes are limited to like charges and unlike charges respectively. As Lange points out,

(11) The fact that P_2 is true counterfactually depends on the fact that P_1 is true, and

(12) The fact that P_2 is nomically necessary counterfactually depends on the fact that P_1 is nomically necessary.

But the truth of P_1 doesn't explain the truth of P_2, and the nomic necessity of P_1 doesn't explain the nomic necessity of P_2. My response is the same as to the first example. The fact that P_1 is true is neither a MoPF nor an FML nor an FNL, and the same is true of the fact that P_1 is nomically necessary.[9] Hence, CT* can be applied neither to (11) nor to (12). Someone could still try to extract a counterexample to CT* from the Coulomb's-law case by claiming that

(13) The fact that P_2 is a natural law counterfactually depends on the fact that P_1 is a natural law,

and by then pointing out that the fact that P_1 is a law doesn't partly explain the fact that P_2 is a law. Now, (13) is true only if P_1 and P_2 are indeed natural laws, and I think it's debatable whether that is so. (P_1 and P_2 are entailed by the natural law C, but I deny that

[9] Note that nomic necessity is a different property from fundamental natural lawhood. The two properties are not even coextensive (as pointed out above, the fundamental natural laws aren't nomically necessary on my view). Hence, the proposition that P_1 is nomically necessary doesn't state a fact about which principles have the property of fundamental natural lawhood.

natural lawhood is closed under entailment. See *MER*: 172–173.) However that may be, it seems clear that *if* P_1 is a natural law, then that fact is explained by the fact that C is a law, so that P_1 is not a *fundamental* natural law. The fact that P_1 is a law is therefore not an FNL. Since it's not a MoPF or FML either, CT* doesn't apply to (13).

References

Chalmers, D. (2002). "Does Conceivability Entail Possibility?" in T. Gendler and J. Hawthorne (eds), *Conceivability and Possibility*. Oxford: Oxford University Press, 145–200.

Correia, F. (2010). "Grounding and Truth Functions," *Logique et Analyse* 53: 251–279.

Edgington, D. (2003). "Counterfactuals and the Benefit of Hindsight," in P. Dowe and P. Noordhof (eds), *Causation and Counterfactuals*. London: Routledge, 12–27.

Fine, K. (2012). "A Guide to Ground," in F. Correia and B. Schnieder (eds), *Metaphysical Grounding: Understanding the Structure of Reality*. Cambridge: Cambridge University Press, 37–80.

Jackson, F. (1998). *From Metaphysics to Ethics: A Defence of Conceptual Analysis*. Oxford: Oxford University Press.

Kment, B. (2006a). "Counterfactuals and Explanation," *Mind* 115: 261–310.

Kment, B. (2006b). "Counterfactuals and the Analysis of Necessity," *Philosophical Perspectives* 20: 237–302.

Kment, B. (2015). "Modality, Metaphysics, and Method," in C. Daly (ed.), *The Palgrave Handbook of Philosophical Methods*. Basingstoke: Palgrave Macmillan, 179–207.

Lewis, D. (1973a). *Counterfactuals*. Cambridge, MA: Harvard University Press.

Lewis, D. (1973b). "Counterfactuals and Comparative Possibility," *Journal of Philosophical Logic* 2: 418–446.

Lewis, D. (1979). "Counterfactual Dependence and Time's Arrow," *Nous* 13: 455–476.

Lewis, D. (1986). "Causal Explanation," in *Philosophical Papers*, vol. 2. New York and Oxford: Oxford University Press: 214–240.

Nolan, D. (1997). "Impossible Worlds: A Modest Approach," *Notre Dame Journal of Formal Logic* 38: 535–573.

Railton, Peter (1981). “Probability, Explanation, and Information,” *Synthese* 48: 233–256.

Rosen, G. (2010). “Metaphysical Dependence: Grounding and Reduction,” in B. Hale and A. Hoffmann (eds), *Modality: Metaphysics, Logic, and Epistemology*. Oxford: Oxford University Press, 109–135.

Stalnaker, Robert. 1968. “A theory of conditionals,” *American Philosophical Quarterly Monographs* 2 (Studies in Logical Theory): 98–112.

Williamson, T. (2005). “Armchair Philosophy, Metaphysical Modality and Counterfactual Thinking,” *Proceedings of the Aristotelian Society* 105(1): 1–23.