

Lange, Lewis, and One Lonely Proton

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Lange's criticism of Humean Supervenience (HS) plays a key role in his account of natural laws. Though we are sympathetic to his account, we remain unconvinced by his criticism. We focus on his thought experiment involving a world containing nothing but a lone proton and argue that it does not cast sufficient doubt on HS. We conclude with a discussion of the problems facing an ontology of primitive subjunctive facts.

1. TWO CHALLENGES FOR ACCOUNTS OF NATURAL LAWS

Philosophers have long grappled with two notoriously difficult questions about the laws of nature. (1) *What marks the difference between the facts which are laws and facts which are merely accidents?* Clearly, nothing syntactic — for as Reichenbach noted, the proposition that there are no mile-wide gold cubes and the proposition that there are no mile-wide uranium cubes have the same logical form. Perhaps then laws differ from accidents by “supporting counterfactuals” or otherwise enjoying some close connection to subjunctive facts. While there is probably something to this general suspicion, it has become increasingly clear both that otherwise unremarkable accidental generalizations can also “support” counterfactuals and more generally that the language of “support” is (as it stands) too vague to fulfill this philosophical role.

(2) *What are the “truth-makers” for laws?* This question might be interpreted in two different ways: (a) *What are the truth-makers for the facts which are laws?* and (b) *What are the truth-makers for those facts’ “lawness” (what makes them laws rather than accidents)?* *What, in other words, are the “law-makers” for laws?*² Now, though related, these questions are distinct. For distinguishing laws from accidents — by some fixed-up criteria like those above, for example — needn't shed any light on what makes those criteria obtain. It hardly seems true *a priori* that a truth-maker for a proposition of the form ‘All Fs are G’ would also make true a proposition of the form ‘It is a law that all Fs are G’ (or vice versa); after all, these are distinct propositions.

Of course, *some* approaches to question (1) above concerning the distinction between the laws and the non-laws provide an answer to (2b) the law-maker question. By far the most well-known of these answers is David Lewis' Best Systems Approach (BSA) to natural laws, which construes laws as certain sorts of summaries of non-nomic states of affairs. Allied with his Humean Supervenience (HS) thesis — according to which the laws of nature (and everything else) supervene on the “non-nomic facts”³ — Lewis offers a powerful and seductive account both of how laws differ from accidents and what makes laws true. While cashing out HS precisely is no simple matter (see Loewer 1996), the intuitive thought seems clear enough: characteristically nomic matters (laws, causation, dispositions, and such) do not float free from characteristically “occurrent” phenomena. Put another way: point-by-point spatiotemporal duplicate worlds are duplicates *simpliciter* — and in particular, nomic duplicates.

¹ Authors' names listed alphabetically (or in increasing order of height, or . . .); in other words, this essay is fully collaborative. We would like to thank audiences at Duke University and the Idaho Metaphysicists for helpful and encouraging comments on earlier drafts. We owe Marc Lange special thanks for both stimulating our thinking about natural laws and generously engaging our reactions to his view on many occasions.

² we borrow this nomenclature from Marc Lange's forthcoming book *Laws and Lawmakers* (Oxford 2008).

³ e.g., the law, 'All dogs go to Heaven' supervenes on the non-nomic fact that all dogs go to Heaven.

Many find Humean Supervenience incredible. For many reasons: Laws are supposed to *govern* the non-nomic facts, not the other way around. Laws are necessary whereas summaries appear to be contingent. Supporters of HS deny these intuitions as relics of medieval conceptions of laws according to which laws are thought to be an “extra ingredient” in the world — they worry that this renders them mysterious, “queer”, and thus epistemically remote (see Earman and Roberts 2005a and b). Very roughly: If the laws could float completely free from the non-nomic facts and if we’re only in epistemic contact with those facts, then we might worry that nomic skepticism follows. Denying HS only exacerbates the problem with which we started by affording a classic “underdetermination-style” skeptical argument (cf. Skow 2007).

Deniers of Humean Supervenience — whether they deny that an extensive skepticism follows from their denial or accept it with grace — ask how what might be could reasonably be constrained by what is. They hold that two non-nomically duplicate worlds could nevertheless differ in their laws. This intuition, deniers suggest, is especially clear in certain kinds of impoverished worlds. Consider a world, for instance, in which “there was nothing in the entire history of the universe except a single proton” (Lange 2000: 85; cf. Loewer 1996: 192, Earman 1984: 212). Suppose this lonely proton is moving at a constant velocity. Its motion is compatible with Newton’s laws of motion. But isn’t it possible that it is governed instead by radically different laws (for example, that everything moves at 5 m/s no matter what). If these are genuine possibilities, Humean Supervenience is false (similar arguments have been proposed by Dretske 1977, Tooley 1977, Armstrong 1982, Carroll 1994).

We shall examine this thought-experiment (especially Marc Lange’s treatment of it) in more detail presently. Our contention will be that we lack sufficient reason for finding fault with HS. This thesis follows in part from the way that “lone proton”-type thought experiments are cast and partly from metaphysical considerations concerning the truth-makers of laws and subjunctive facts. Let us bear in mind that HS and BSA are distinct theses. While the BSA is an account of natural law (or family of accounts), HS is better regarded as a constraint upon any account of natural law (or other nomic concepts). One might accept either and deny the other. Appreciating this fact may help alleviate the anti-HS intuitions to some extent. First, let us review the Lewis-Ramsey “Best System Approach” (BSA) to natural laws as a particular way of filling out the Humean Supervenience account.

2. THE BEST SYSTEMS APPROACH

F.P. Ramsey once held (but later abandoned) the view that laws are “consequences of those propositions which we should take as axioms if we knew everything and organized it as simply as possible in a deductive system” (Lewis 1973: 73). Excising the condition that we know everything, we can imagine “innumerable true deductive systems: deductively closed, axiomatizable sets of true sentences” (*ibid.*: 73) Which sentences are in these sets? Collectively, all and only the true sentences. Individually, there is any combination of true sentences you like. One set has all the true sentences. Another set might contain only the (logical closure of the) facts about the first ten minutes of the world.

Some of these sets can be axiomatized more simply than others. Sets containing loads of particular, insignificant facts (facts about the distance between you and various objects in the room, facts about the sum total of dust particles throughout history) — little details like that — may be impossible to axiomatize in such a way that all these little details jointly follow. Unaxiomatized, they supply incredibly specific (if boring) knowledge about the world. Other sets contain relatively few particular facts — very little detail — but are very easy to axiomatize. That is, it’s easy to find a set of sentences from which all the other truths in the set

follow. "Simplicity without strength can be had from pure logic, strength without simplicity from (the deductive closure of) an almanac" (*ibid.*: 73).

The set of sentences that we would choose as a complete description of the universe would be the one which best combines simplicity and strength. On Ramsey's theory, then (as restated by Lewis), "a contingent generalization is a law of nature if and only if it appears as a theorem (or axiom) in each of the true deductive systems that achieves a best combination of simplicity and strength" (citation). In terms of Lewis's theory of possible worlds, it follows that a generalization is a law of nature at the actual world if and only if it appears as theorem in (each of) the best deductive system(s) for that world.⁴

3. NATURAL NECESSITY

One of the more puzzling intuitions defenders of a robust conception of natural law face is that of the particular "intermediate" kind of necessity that natural laws apparently enjoy. They seem both more necessary than purely contingent, accidental facts and less necessary than logical truths. Currently popular ("deflationary") conceptions of natural law dissolve this problem by either numbering the laws with the contingent facts or the necessary truths (though in each case still regarding them as somehow special). While Lewis brings the laws down to earth as holistically, as special summaries, Scientific Essentialists regard laws as metaphysically necessary expressions of the causal powers of natural kinds. But both of these accounts face their problems — many of which extend precisely from not providing an account of natural necessity.⁵

An account of natural necessity would presumably help with the first challenge of distinguishing laws and accidents. To this end, Marc Lange has long campaigned for a particular account of the relation between laws and subjunctives. Very roughly, he proposes that the laws are the set of truths which would still have held had any fact which is logically consistent with the laws obtained for any nested sequence of such facts. Think of it this way: the law that copper is electrically conductive would still have obtained — and indeed, would still have been a *law* — had you not brushed your teeth this morning. And that's not all. Had you not brushed your teeth this morning, then had the sun gone nova, then copper would still have been electrically conductive. And so on — but only apparently for counterfactual suppositions that are consistent with the laws as a whole. Would copper have still been electrically conductive had the speed of light been double what it is or had electrons been 1% more massive? Personally, we have no idea (though we suspect that those counterfactuals would at least be "untrue" or "not assertible", if not simply false). But note how different our confidence is in the different cases.

In contrast, the only collection of truths that possesses the same kind of stability — what Lange dubs "non-nomic stability" — is the set of all truths. For every other set of truths, it seems readily possible to find some counterfactual supposition consistent with the members of the set under which at least some member of that set would go false. Take, for example, the set of truths consisting of the logical closure of the fact that there are no mile-wide gold cubes. Plausibly, had Bill Gates wanted such a gold cube built, that fact might well go false.⁶ Not so for the no-uranium-cubes example: even if Bill Gates had wanted a mile-wide cube of solid uranium built, there would (still) have been no such cube — at least, not for very long — even if there had been more uranium

⁴ Note how the BSA could have run afoul of HS. The laws might well still supervene on *some* collection of facts, but for all that's been said so far, they could be an utterly different collection. We could start with the logical closure of the set of propositions that would have obtained if Rome had not fallen, if we wanted to. Likewise, HS could abandon the BSA, so long as the laws supervened on the "Humean mosaic".

⁵ We obviously cannot convince the unconvinced reader of this here.

⁶ This example is Lange's (forthcoming).

in existence. Lange's proposal thus appears to make sense both of the special kind of necessity that laws enjoy and of their special connection to subjunctives. They are stable: "*collectively, taken as a set, the laws are as resilient as they could logically possibly be. All the laws would still have held under every counterfactual supposition with which they could all still have held*" (2005a: 424). Their stability explains how we can rely on them in science.

4. LANGE CONTRA LEWIS

Lange's criticism of HS plays a crucial motivating role in his proposal. Though we are sympathetic to his account, we remain unconvinced by his criticism. For Lange, the laws are additional to and independent of the non-nomic facts — he pictures them like so much "powdered sugar sprinkled over the doughy surface of the non-nomic facts" (Lange 2000: 51), neither supervening on nor in any way constrained by the pedestrian details which function as law-makers for HS.

Ah, says the Humean, I know where you're going with this. You're going to give me a thought experiment about a nearly empty world and ask, isn't clear that the same laws which govern our world could govern this world, or different ones, but in any case laws that float free from the (impoverished) Humean Base.

The Humean will reply that this objection merely begs the question against HS. Beebe (2000), for example, argues that the intuitions that underpin the impoverished-world-style thought experiments (familiar from Tooley 1977, Dretske 1977, Carroll 1994, and the like⁷) presume a "governing conception" of natural laws which she finds difficult to make sense of — and in any case is not a necessary feature of the concept of a natural law. Lewisians deny that laws govern in any substantial sense, so insofar as these thought experiments rely on intuitions to the contrary, they fail to compel acceptance.

Perhaps Lange can avoid this runaround. The principal motivation behind his denial that laws are constrained by the non-nomic facts is the intuition cited above that many facts about the world could have been different without the laws being different. (So far the Humean agrees.) In the closest world in which you don't brush your teeth this morning, it would still be a law that $F=ma$. We can generalize from this. The tooth-brushing example suggests that the laws of nature would not have changed had there been "nothing in the entire history of the universe except a single proton" (Lange 2000: 85). The preservation of the laws across such radical changes in non-nomic facts indicates that the laws are not constrained by the non-nomic facts in the way Humeans suggest. Since they cannot make sense of this intuition about the sameness of the laws in our world and in a lone-proton world, goes the argument, HS must be false.

We will argue that Lange's intuition that the laws would have been the same in the lone-proton case derives not from a feature of our concept of natural law which allows laws to float free from the non-nomic facts, but rather from a feature of his lone-proton thought experiment which fails to direct us to an alternate possible world whose non-nomic facts differ from those of the actual world. If this is right, then Lange has failed to show that the laws would have been the same despite radical changes in the non-nomic facts. We will further argue that Lange's intuition that "two worlds containing exactly the same non-nomic facts can disagree in their natural laws" (Lange 2000: 89) fails for precisely the same reason — i.e., he just doesn't get the (non-nomic) facts right.

There is a well-known rule of thumb for determining things like what the laws of nature would have been had there never been anything nothing but a single proton. The procedure (developed most explicitly by Lewis himself) is to look at the closest world to the actual world in which there has been nothing but a lonely proton,

⁷ We don't mean to suggest their arguments have been so simplistic. But the discussion of each goes well beyond the scope of this paper.

and see whether the actual laws obtain. There are lots of possible worlds in which there is nothing but a single proton. But in order to apply our rule of thumb, we need to know which one is the closest.

How do we determine which lone-proton world is the closest? On Lange's view, "we call forth [the closest lone-proton world] by impoverishing the actual world" (85). "The closest lone-proton world is arrived at by beginning with the actual world and then severely depopulating it" (87). We agree. Lange is exactly right in his characterization of which lone-proton world we are directed to when presented with the counterfactual antecedent "Had there never been anything but a single proton." More importantly, we think David Lewis would have agreed with him, based on his recommendations for judging "world proximity" (developed in his 1979). According to Lewis, the first thing we would normally do to decide which of the lone-proton worlds are the closest would be to see which of them share our laws of nature. Obviously we cannot do that here, since it is the laws of nature themselves which are in question. We must then look to the histories of the various lone-proton worlds, and observe the extent to which those histories resemble our own (Bennett 2003). The worlds whose histories most closely match ours are to be considered the closest.

Keep in mind that Lange does not mean for us to consider a world which is, as it were, *actually depopulated* (say, one that looked very much like ours, but which — as a result of a series of matter–anti-matter collisions — got pared down to a single proton). Rather, we are supposed to simply "call to mind" a permanently sparse world by thinking about what our world would be like had we removed everything in it. But to the extent that our conception of this lone-proton world is dependent upon our conception of the actual world, in contemplating this lone-proton world, we bring along our beliefs about the actual world, including our beliefs regarding which regularities have held until now. Lange seems to agree:

The reason why the laws in the closest lone-proton world extend to so many kinds of things unrepresented there [e.g., electrons] is that this possible world is picked out by its relation to the actual world. In the closest lone-proton world, the electron is natural kind of particle because we call forth this world by impoverishing the actual world — where the electron is a natural kind of particle. The supposition that there is nothing except a lone proton diminishes the population of the world but not the *kinds* of things that are there. (Lange 2000: 87, his emphasis)

For the same reason that the kinds of the actual world are preserved when we contemplate the closest lone-proton world, the patterns and regularities that characterize the actual world's history (and which are exhibited by the actual world's natural kinds) come along for the ride as well. And if our contemplation of Lange's lone-proton world is strongly informed by the actual world's history, simply stipulating that in the entire history of that lone-proton world there exists only one proton is not enough to counterbalance the fact that what we are doing implicitly is imagining a world that shares all of the historical facts which characterize our world. The actual world's history is an essential feature of the closest lone-proton world.

But if the actual world's history is an essential feature of the closest lone-proton world (Lange's stipulation to the contrary notwithstanding), then Lange has just directed us to a world with the same historical facts as the actual world. But a world with the actual world's history is obviously *not* a world in which there has never been anything except for a lone proton. That's trouble: it would seem that the world to which we're directed by the counterfactual antecedent "Had there never been anything except for a lone proton" is not a world in which there has never been anything except for a lone proton! Instead, it is a world identical to ours in non-nomic facts up until the time we start mentally depopulating it. If indeed the laws of nature are the same in our world as in the closest lone-proton world to which we're directed by Lange's thought experiment, we suspect that is probably because they agree in this broad swath of non-nomic history.

Lange observes, correctly in our estimation, that our judgment concerning whether the actual laws would have remained the laws had there never been anything but a single proton shifts when we imagine that this world has been “designed ‘from scratch’” (Lange 2000: 87), or when we entertain the counterfactual antecedent “Had God created nothing but a single proton,” or the like. We think that the best explanation for the shift in intuitions from the depopulated lone-proton world to this “bottom-up” lone-proton world is that it successfully does away with the influence of the facts about the actual world’s history. We are no longer considering the actual world minus a bunch of stuff, as we were being asked to do in the “depopulated” world; we’re considering something entirely different: a world which really does seem to have a history very different from that of the actual world, a history in which there really has never been anything except for a lonely proton, contrary to the ersatz eternally lonely-proton world to which we were directed by the counterfactual antecedent from the previous example, when the laws turned out to be preserved (viz., “Had there never been anything except for a single proton”). We agree with Lange that “the laws of nature in this universe are different from those in the closest lone-proton world” designed “from scratch,” or at least we have no reason to think they are the same (Lange 2000: 88). But we disagree that what we have here is a case in which the laws of two worlds differ while their non-nomic facts remain the same. Their non-nomic facts are, instead, quite different, owing to the differences in histories to which we’re directed by the different counterfactual antecedents.

Here’s a way of summarizing our criticism. Lange invites us to consider a world with only a lone proton in hopes of casting doubt upon HS and BSA. But it matters *how* we consider such a world. A “from-scratch” lone-proton world doesn’t overly trouble the Lewisian. A “depopulated” lone-proton world, on the other hand, takes advantage of the intuition (shared by both parties) that laws would still be true had lots of little things gone differently. But here too, we have at least two ways of interpreting “depopulation”: we can imagine a world like ours from which objects *are removed* (annihilated, through some nomological means) or we can imagine a world like ours from which we simply “imagine away” objects in an atemporal sense (we conceptually subtract them from the spatiotemporal block). No doubt, this latter sense is what Lange has in mind. But we must ask: *what is it to imagine away objects?* And supposing this *does* make sense (we’re just not sure), why should it have any bearing on what laws are true at some possible world? Is it not simply a “built-from-scratch” world conceived of “as impoverished”? Would not we face the same intuition stand-off? The former sense of “depopulation”, in contrast, *does* make sense but doesn’t clearly trouble the Lewisian. So while our intuitions largely agree with Lange’s with respect to the laws’ preservation and relation to subjunctives, we believe that he fails to establish the falsity of HS (or even cast much doubt upon it). Indeed, his thought experiments appear to establish precisely what he designed them to refute. They show that changes in laws do, in fact, track changes in non-nomic facts — to what extent, we remain undecided.

In addition, we think that there is a general lesson to be drawn here with respect to the rules governing the evaluation of counterfactuals. Our criticism of Lange (and indeed, as we have argued, Lange’s own words) suggests that it is possible for the sort of world to which we are naturally psychologically directed by some counterfactual antecedent A to differ from the sort of world explicitly mentioned by that counterfactual antecedent. This dissonance is nowhere more likely to obtain than in cases where we are barred from using the traditional criteria for judging world-proximity (e.g., sameness of laws of nature). If, as Lewis and countless others have suggested, we appeal primarily to the resemblance of a possible world’s laws to ours to judge its proximity, evaluating counterfactuals that ask us to suspend our beliefs about what the laws are like is going to produce results in which we should little confidence. Any evaluation of counterfactuals is going to be derived from implicit assumptions about sameness of laws. And if that’s true, temperance bids us to suspend judgment

regarding how we arrived at our judgment about law-similarity: was it because (a) the laws at the closest sort of world explicitly mentioned by A *really are the same* as the actual world's laws; or (b) we're automatically directed to A-worlds which share our laws? We have tried to provide an explanation of how, using the Lewisian framework, one could account for the intuition that the laws at the world called for by the antecedent "Had there never been anything but a single proton" are the same as our laws. Ignoring law-similarity, we psychologically treat to history-similarity, and the "never been anything but" proviso is no match for the deeply embedded rules for evaluating counterfactuals. On the Lewisian account, history-similarity can explain law-similarity. Worlds such as the "Had God created a"-worlds, we suggest, sufficiently avoid invoking the actual world's history. It's quite plausible that the explanation for the ease with which we see these worlds as having laws different than ours is because of their explicit reference to divine intervention — i.e., *miracles*. As it happens, failing tests for law- and history-similarity, on Lewis' account the occurrence of miracles is supposed to tell us how close a world is to our own (Lewis 1979: 472), where the degree of similarity of a possible world to ours varies inversely with the frequency of miracles at that possible world.

5. THE LAWMAKERS THEMSELVES

Another, more general, source of skepticism concerning Lange's anti-Humean arguments concerns the role of the intuition that the laws would remain laws even if many things (compatible with the laws) had been different. Is this intuition strong enough to take us all the way to a lone-proton world?⁸ We have our doubts. What would have to be the case for there to have been only one lonely proton in the entire history of the world? Frankly, we have no idea. It's clearly broadly-logically possible that there would be only a lonely proton — no contradiction is even *hinted* at by this suggestion. But is it *nomologically*-possible? Well, that's the question, isn't it?⁹

Suppose that instead of a lone-proton world, we imagine a world with a lone sodium atom. Would it still be the case that, had there been nothing in the entire history of the world but a lone sodium atom, that (given the chance) it would still react with chlorine to form salt? If we are right that simply "mentally impoverishing" the actual world poses no real threat to the Humean, we must consider a world "built-from-scratch" that contains nothing but a sodium atom. What would a world like this look like? So far as we know, sodium is produced in dying stars as lighter atoms fuse together. Had this process been "unavailable", it seems much less clear (to us, anyway) that a lone sodium atom would be nomologically possible, or that it would still be governed by the same laws.¹⁰ So the relevance of the intuition that the laws would have remained laws as the universe is gradually impoverished to our thinking about what would be the case in a built-from-scratch world seems to depend on what our *target* lone-something-or-other is.

Consider an analogy. A landing party from the *Enterprise* sets down on a remote and desolate planet, devoid of life. Curiously, they find (what appears to be) a GMC Jimmy gassed up and with the keys in the ignition. Knowing how unreliable Jimmys were, they hesitate to drive it around. But then it occurs to them: *all bets are off*,

⁸ Perhaps it is an intuition like those responsible for Sorites-style arguments — it looks safe for a handful of motivating test-cases, but leads to intolerable conclusions. Of course, we do not claim outright that the anti-HS conclusion is intolerable.

⁹ Anyway, that's *part* of the question (see below).

¹⁰ Of course, sodium might be produced in other nomologically-possible ways (by cleverly manipulating neon, perhaps) — that's not the point. The question is whether any of these ways is compossible with there being only one sodium atom in the entire history of the universe. This seems to us a deep and substantive question about the origin of the universe (and whether its origin could have been utterly different) — it scarcely seems *obvious* that there could have been an ever-lonely-sodium atom. Ditto for the proton.

right? After all, we have no idea how this truck got here! Indeed, *something* strange must be afoot. Later, when the gravity plating onboard stops working, you can bet that Kirk will start his investigations with the Jimmy.

Now the sodium and Jimmy analogies only show so much. After all, Lange could concede the point that for these cases (and even for lone-proton case) that the laws' preservation was doing more work than it was cut out for. It would just remain for him to change the example appropriately — a lonely quark? — where the laws clearly float free from the more humble Humean base. But at this stage, we worry that Lange simply joins the intuitions tug-of-war between the Humeans (like Loewer and Beebe) and anti-Humeans (like Carroll and Tooley) and loses what's distinctive and compelling about his anti-Humean argument.¹¹ While we have no transcendental argument that the preservation intuition cannot by itself generate neutrally problematic cases for HS, we have trouble seeing that it *does*.

Another general source of concern involves the lawmakers themselves. Here we ask the reader's forbearance for a little joint autobiography. While Lange made an impressive case for his answer to the first challenge we mentioned above — the relation of laws and counterfactuals —, he was relatively mum about the second: what makes the laws true. He reflected at the end of a (2005a) paper summarizing his proposal that his purpose has been only to address the relationship between laws and counterfactuals:

I have not addressed the question of which of these relata is ontologically prior to the other. Perhaps laws help to support, to underwrite, to sustain various counterfactual conditionals. On the other hand, perhaps counterfactuals (relativized to context) are as ontologically basic as actuals, and they fix which facts are physically necessary by determining which sets are stable. As a third alternative, perhaps something else is ontologically prior to laws as well as to counterfactuals, serving as a truth-maker of each and thereby putting laws and counterfactuals into the relation that I have described. I have adopted no position regarding this very difficult issue. (427)

We wondered what his conclusion would be. Which *are* ontologically prior: the laws or the counterfactuals (or does something altogether different — a Humean mosaic, say — underlie both)? Assuming we accepted his answer to the relationship question, how would *we* approach the lawmaker question?

Primitivism about laws never seemed to us particularly compelling — nor could we see how to garner any confidence in Lange's proposal about the laws-counterfactual relation in this case. If the laws were *primitives*, who knows what the nature of their support of counterfactuals would be. Their status as laws could not obviously be called into question by a surprising result here. If, for example, assertions of lawhood and assertions about counterfactual correctness conflicted with Lange's proposal, the assertions of lawhood would tend to trump either the assertions about the counterfactual or the laws' proposed relationship thereto.¹²

What of the two remaining options? Lange's anti-Humeanism clearly ruled out both laws and counterfactuals supervening on categorical facts. That leaves primitivism about subjunctive facts — apparently better able to account for laws particular "intermediate necessity" and complicit in other puzzling questions, like how we should understand instantaneous velocity. Lange wrote suggestively in this connection of the possibility "that laws themselves acquire their nomic status by virtue of the truth of various subjunctive conditionals"; that

¹¹ Well, perhaps an intuition tug-of-war is all that can be hoped for. Lange has admitted to us along these lines that he is not overly concerned with converting the committed Humean. Perhaps we ought to let his account meet with the tribunal of philosophical intuition as a united whole. Fair enough. But we are not committed Humeans. And inasmuch as his account of natural law receives motivation from his anti-Humeanism, convincing the merely neutral would seem a reasonable (though admittedly dispensable) goal.

¹² It might be argued that this situation would not even arise for the nomic primitivist — for if laws underwrite counterfactuals (and Lange was correct about the specifics of this underwriting), how *could* there be a conflict. Our point is epistemic: even if subjunctives were ultimately beholden to the laws, we might well make use of other sources of information about them and (Lange's proposed relationship notwithstanding), a conflict of *belief* (or commitment) might well occur.

“subjunctive facts may be ineliminable” (2005b: 461). A convergence seemed to be accumulating — and finally the curtain was pulled back: *primitive subjunctives are the lawmakers!*¹³ But now that we’ve seen the wizard, so to speak, we worry about the management of Oz.

Many questions gnaw at us. Can we reasonably speak — as Lange is fond — of the laws as *governing* (in any substantial sense) if they merely supervene on subjunctive facts. When the King or Kantian Moral Law guides my actions, it does so by constraining what actions I *would* perform if certain states of affairs had obtained. Being a moral person plausibly depends not only on *actually* behaving or thinking in a particular way, but on having certain sorts of other-directed subjunctives determined (“governed”) by certain sensibilities. Something like this picture of governance seems to underlie the old thought that laws support counterfactuals. Reversing this relationship of support apparently trades away nomic governance. At most, Lange has *primitive subjunctive governance*. Does this afford a thick metaphorical sense of “nomic governance”? We’re not sure.¹⁴

What concerns us more, however, is the claim (motivated by the lone-proton thought experiments) that radically impoverished worlds might nevertheless feature a rich ontology of subjunctives. Perhaps even *empty* worlds could feature wildly different subjunctive facts. Subjunctive primitivism brushes away pointed questions like, “*but what could make all those subjunctive facts true?*” But nor does it offer much reason for *accepting* the intuition. Suppose (*per impossibile*) we attend to a *one-lone-proton-plus-one-lone-physicist* world. Our expectations for her discoveries about what subjunctives (and thus what laws) are true in that world will, understandably, be low. Not to say that dire epistemic straights need entail *metaphysical* doubt, but it may nevertheless *suggest it*.¹⁵

Lange might here defend his subjunctive primitivism indirectly (in somewhat the manner of David Lewis’s defense of concrete *possibilia*): on the grounds of its philosophical fruitfulness. Add to this a theoretical need for some irreducibly subjunctive facts to account for important scientific concepts (instantaneous velocity, and perhaps causation and dispositions), and subjunctive primitivism starts looking like a tempting pill to take.

We tend to wonder if philosophers don’t put too much stock in identifying the relative ontological positions of “certain classes of facts”. Even supposing we have indisputable reason for accepting *some* irreducibly subjunctive facts, surely this needn’t push us into subjunctive primitivism whole hog. Perhaps subjunctive facts obtain for a whole raft of reasons — because of the causal powers of certain natural kinds¹⁶, because of certain categorical facts or dispositions; and perhaps sometimes *just because* (or because of a combination of any of the above). We see no particular reason to favor “strict class segregation”.

¹³ See Chapter 4 of *Laws and Lawmakers*.

¹⁴ It’s not quite right to brusquely discount this sense of governance on the grounds that subjunctives cannot govern *actual* states of affairs. First, subjunctives often bear on what would *still be the case* had such and such occurred. Second, even purely counterfactual conditionals might be taken to concern the *future* (e.g., the fact that *if you were to throw that drink in Dave’s face, he’d punch you* might *someday* explain (“govern”?) my punching you. We wonder if the temporal–modal analogy isn’t often behind our judgments about what subjunctives are true. Any confidence in the proposition that *Dave would punch you if you threw a drink in his face* is likely to arise (directly or indirectly) from previous experience with Dave.

¹⁵ At this point, one might be tempted to try for a reductive analysis of subjunctives that coheres with HS. Indeed, we could still accept Lange’s proposals about the relation (and relative “metaphysical position” of laws and subjunctives) if this an analysis succeeded. While such an account would have the advantage of bringing subjunctives closer to our ken, it would no doubt face significant difficulties (like that noted in Lange 2005b).

¹⁶ Lange hints in his early discussion of the lone-proton thought experiment that natural kinds might have some theoretical role to play in fixing subjunctive facts (“The supposition that there is nothing except a lone proton diminishes the population of the world but not the *kinds* of things that are there” [2000: 87, quoted above]). We don’t know whether this suggestion is still on the table or what conception of natural kinds would serve this role.

Ironically, though, this presumption seems to be one of the few plots of common ground between Lewis and Lange. Perhaps both should abdicate. Just as one might accept HS without accepting the BSA (and vice versa), one might maintain the *spirit* of HS without cleaving to the *letter*. One might, for instance, accept a *broad, but not comprehensive* supervenience thesis — that *some* but not all subjunctive facts supervene on a kind of Humean base; or perhaps that subjunctives as a whole supervene on the Humean base plus a subset of brute subjunctives. Admittedly, we only have the vaguest notion of how such a view might come together — but it seems both coherent and attractive (*prima facie*, at a distance, at least). For two reasons: first, it is compatible both with Lange’s proposal about the relation between laws and subjunctives and our puzzlement over radically impoverished worlds.¹⁷ Second, it doesn’t say too much about what is ontologically primitive. The second (rarely appreciated) virtue may be only temporary, but it seems appropriate to our current level of philosophical enlightenment. Perhaps we should never have insisted on drawing back the curtain and retained the language of the *commitments* we undertake to natural laws within scientific practice. We seem to know much about subjunctive facts — and we can occasionally explain *how* we know that these facts obtain (though perhaps not at a very deep level), but it seems to us that we remain relatively distant from a fully-satisfactory account of either their metaphysics or epistemology. We’re not placing our bets on one horse quite yet.

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¹⁷ We follow Lange in recognizing that compatibility may not always be a good thing. He responds to Handfield’s suggestion that essentialism and “Langanism” could be happily married, that “this ‘flexibility’ is a symptom of essentialism’s explanatory impotence as far as the laws’ relation to counterfactuals is concerned” (2005c: 586). We do not believe we are subject to this sort of objection — at least no more than Lange himself is in taking subjunctives as primitive. Think of us as simply remaining metaphysically wary.