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# *On the Metaphysical Contingency of Laws of Nature*

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In the old days—good or bad, depending on your views—it would have been very hard to propose that the laws of nature are necessary 'in the strongest sense' and be taken seriously.[1] After all, what the laws of nature are is a matter for empirical investigation, and however they turn out, we can imagine them having been otherwise. When scientists look for laws, there are various hypotheses as to what the laws might be, and so long as there is no hidden contradiction, any of these is conceivable, and so represents what the laws *are* in some (set of) possible world(s). Certainly, the laws of nature may represent, or underlie, weaker sorts of necessity—physical, biological, psychological, or economic necessity—but such necessity would be understood as being compatible with contingency in a wider sense. Maybe, as things are, this unsupported cup has to fall—but surely the laws could have differed so that under the very same conditions, it would *not* fall. We can surely *imagine* it, and in the old days, this would have been enough.

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[1] For an exception, see Kneale (1949).

Saul Kripke changed all that, with help from Hilary Putnam.[2] They convinced most philosophers that there are necessary truths which are not analytic or a priori, and before long, all kinds of things which seemed clearly contingent, on grounds of being empirical and the imaginability of their negations, were being claimed to be necessary. More specifically, the idea that one could establish a possibility by conceiving or imagining it (or refute a proposed necessity by imagining its negation) has come in for harsh treatment, and it is far from uncommon to see such conceivability arguments, or considerations, simply brushed aside like so many tea-leaves.

Thus it no longer seems so clear to many that the laws of nature are metaphysically contingent, and a number of philosophers actively propose that they are, in fact, necessary in the strongest sense,[3] and many more philosophers are willing to take the idea seriously, despite the seemingly clear contrary testimony of the traditional tests for necessity and possibility.

I think the old days were the 'good' old days, and while I agree that there are necessary a posteriori truths, I don't think they are in any interesting sense 'metaphysical', or that they warrant a general suspicion of appeals to imagination as the basic method of modal inquiry.[4] Correspondingly, I think the laws of nature are either contingent, or, if they are necessary, that this is much less interesting than it may appear at first glance. I shall try to show why in this chapter. While the laws of nature are my explicit topic, I intend this as an illustration of the more general misuse, or misinterpretation, of the possibility of a posteriori necessities, and of the importance of traditional imagining, conceiving, and thought experiment to modal inquiry.

## 1 Imagining Our Laws of Nature Not to Obtain

In this section, I will describe a number of ways in which we can conceive our actual laws of nature to fail to obtain. If these conceived situations are genuine possibilities, then the laws do not obtain with full, or metaphysical, or 'the widest kind' of necessity. Some may find the number of examples a bit much—the conceivability is obvious from the start, so why not just posit it and move on? And some will find it wholly irrelevant (a partially overlapping group),

[2] Kripke (1971, 1980); Putnam (1975).

[3] Among the more visible are Shoemaker (1984, 1998); Swoyer (1982); Harré and Madden (1975); Fales (1993); Tweedale (1984).

[4] I argue this in Sidelle (1989), henceforward *NEI*. See also sect. 2 below.



since the necessity of laws of nature is presumably metaphysical, not conceptual, so we are in the realm where 'conceivability is no proof of possibility'.[5]

The latter charge I will address in sections 2 and 3. For now, notice that even the arguments of Kripke and Putnam, showing that we can, on occasion, conceive the impossible (or conceive something other than we think), rely on such thought experiments. In fact, they rely on thought experiments of *just the form* we are using: take for granted that some fact *actually* obtains, and then consider whether it might nonetheless fail in some other possible situation.[6] So, while I grant that such imaginings are defeasible—we can be argued out of them—those who have been convinced by Kripke and Putnam have no basis for denying, and are in no *position* to deny, that these sorts of imaginings constitute at least a prima-facie case for the possibility of their contents.

As for the charge of overkill, my hope is that seeing the nature and variety of ways in which the laws of nature seem to be contingent will help us better see both the difficulty of plausibly maintaining that they are necessary (at least, in a metaphysically interesting way) and the inability of the purported necessity to do the jobs for which it has been postulated. So—on to the examples, most or all of which have probably been presented in various contexts by other philosophers.[7]

### 1.1 *'Obvious' Imaginability–Non-Incoherence*

The simplest way to see that the laws of nature can be imagined otherwise is just by noting that they are not analytic or a priori, and so there is no incoherence in postulating their falsity in some other situation. We can always construct models involving the same properties, magnitudes, and/or forces, models that involve no explicit contradictions. One can just keep it at this level, or give

[5] Putnam (1975: 233).

[6] Thus, for instance, suppose water is actually composed of $H_2O$; could this fail to obtain in another possible situation? This contrasts with the more traditional, more simple 'Can you imagine water not composed of $H_2O$?' While Kripke's and Putnam's arguments, if accepted, show that the simpler imaginings can mislead us about possibility, the same does not apply to the 'premised on actual fact' sort—indeed, as I say, the arguments *rely* on such attempted conceivings, although admittedly there are arguments adduced to influence our judgments about the proper way to describe these imagined situations.

[7] I should say in advance that some of the cases may not be fundamentally different; if so, I apologize, but nothing hinges on the total number. For some other, and often related, examples, see Kit Fine's 'The Varieties of Necessity', Ch. 6, sect. 2 above. The presentations differ, in part, because our purposes criss-cross. Fine's main aim there is to show that not every natural necessity is metaphysically necessary, whereas I want to show that *none* is 'deeply' metaphysically necessary—which is compatible with *all* being 'metaphysically' necessary.

simple examples. Hume gives us some—imagine one ball striking another at such-and-such a speed and angle, so that, given the actual laws, the second ball must move in such a direction with such a speed: now simply imagine the contact, while the second ball stays in place, or goes off in another direction, or at a different speed, or turns into a tiger-shaped object and eats the first ball.[8] One's first instinct may be to insist that other forces must be in play for one of these things to happen—but why? It's my imagination, and I'm telling you that the balls are just as they in fact are, with *no* other forces.[9]

One may note that I've assumed that the laws (in these conditions) do entail that the second ball would move in a certain way. But what if the laws are probabilistic? Of course, the probabilities would have to be nonzero for *all* the alternatives we can imagine for this to even seem a useful reply, but let us suppose that it is so. Still, we are left with the question of whether in our imagined world, the probabilistic laws that actually obtain, obtain there as well, and while a single imagined instance doesn't show that they don't, we can multiply them to the point where there is scarcely any credibility to the claim that the probabilities there are just what they are here, especially if we imagine the universe to extend infinitely in time, with actual frequencies coming nowhere near the postulated probabilities. Of course, any (nonzero) probability assignments may be logically compatible with any strings of unlikely instances. But it is hard to see what meaning to attach to the claim that in those cases, the probabilities would nonetheless be the same, especially insofar as to respond to *all* the cases we can imagine, one would need to say that no matter *what* the actual frequencies, the probabilities—which, again, are not supposed to be determined simply by logic or meaning—would be exactly the same.[10] This is especially

[8] Replies that these situations are not really possible due to the real natures or essences of the properties involved will be addressed in sections 2 and 3; here, I consider only objections that the cases don't even pass minimal, *a priori* conditions: e.g., that they are not internally coherent, or do not constitute even apparent possibilities of the falsity of the law. (This is another contrast with Fine's presentation, which jumps right into considering such replies.)

[9] There is no problem here insofar as any 'new forces' are the products of the interaction of our objects and properties, and if, in some of the examples, one wants to insist that laws and causal claims by *definition* require forces, then fine, we either have such new forces, or the old forces themselves work somewhat differently. Either way, since the interactions don't produce the actual forces according to the actual laws, we are imagining situations where our laws don't obtain. Throughout the chapter, 'no extra forces' is to be understood this way.

[10] Sense can sometimes be attached in terms of inner features of the properties or magnitudes involved—e.g., a coin that is perfectly evenly weighted may meaningfully be said to have a 50 percent probability of landing tails, even in worlds where it always lands heads. But insofar as probabilities are supposed to be in this way dependent, we can ask whether the probability assignments based on the 'determining' feature are a priori or empirical. If the former, we again don't have



clear when the probabilities are fundamental. (I return briefly to probabilistic laws in (1.5), below.)[11]

Another source of alternative laws focuses on the fact that most (all?) laws express mathematical relationships; they take the form of mathematical formulas. Now, if these are laws of nature, the formulas are not themselves mathematical (plus definitional) truths. So, to conceive the laws of nature being different, we simply need to imagine the specific values in the equations being different; so long as there are no inconsistencies, we will then have a model of a possible situation. One range of alternatives comes from the physical constants. Take, for example, the universal gravitational constant—roughly, $6.67 \times 10^{-11} (N \star m^2/kg^2)$. Surely that could have been different in countless ways. No doubt, change it, and lots of other things change too (supposing no other changes of law, beyond those already entailed)—but we don't need to describe a whole world to know that one differing in this way has mathematically consistent models. Another range of similar cases focuses instead on the relationships, rather than the constants—for example, the gravitational force between two bodies is inversely proportional to the square of the distance between them.[12] Why not to the cube, or some other power or function, of their distance? Or why must the force be directly proportional to the *product* of the masses of the objects? Why not some more complex mathematical relation? In some cases of this sort, there may be some threat that the theoretical terms involved are in fact defined by the relations expressed in the law—maybe 'mass of n grams' is *defined* in terms of the force an object exerts—and there, some purported imaginings will fail. But if the law itself is not simply a truth of definition and mathematics, not all of the terms will be so defined in any such law, so it will just be a matter of figuring out which term should be understood as independent, and conceiving the alternative law accordingly. Additionally, laws that are derived will not be possibly different without a change in the laws from which they are derived (supposing the derivation is in fact deductively valid)—so a consistent model would have to alter any more basic laws.

genuine laws of nature, and if the latter, we can ask what is the basis for determining the connection between that feature and the probabilities. Whatever it is, our imagined world will be one in which that basis differs so as to alter the probability distribution. If there *is* no basis, then it is presumably a brute fact, and consequently, we can just stipulate the equally brute possibility of an alternative probability assignment.

[11] Of course, we could *stipulate* that actual world probabilities be assigned in all these other worlds—but that is right away to dismiss the metaphysical force of the necessity of the law's obtaining.

[12] For simplicity, I'm sticking with Newton here. I hope it is clear that nothing depends on Newton's being right.

But again, (a) we can just start off at the fundamental level, altering the mathematical relationships therein, and (b) given that the laws are empirical, there will always be a way of making any more basic laws so consistent, to provide a coherent model.

Finally, there are other 'physical necessities' that seem in a broader way contingent—why must the total quantity of mass-energy remain the same? Why can't anything travel faster than the speed of light? There doesn't seem to be much trick to imagining these otherwise.

## 1.2 *Theory Competition*

Many of the above cases seem so easy to imagine because we know that the determination of the laws was a product of defeasible empirical inquiry. The gravitational constant was determined long after the acceptance of Newton's Laws, and the nature of the relationships was fought out among various possible theories. Now of course, we don't want to confuse the possibility of having *found out* otherwise with the possibility of things having *been* otherwise—as Putnam and Kripke have argued. Nonetheless, that is clearly not in place in many of these cases. Is there any inclination to say that since the constant *is* G, in worlds where objects produce a force between them, directly proportional to their masses and inversely proportional to the square of the distance between them, but of a somewhat different coefficient, the force would not be gravity? This seems unlikely.[13] So in many, though quite likely not all, cases of competing theories, those that have turned out false provide us with ways the laws could have been different—metaphysically, not just epistemically.

## 1.3 *Can the Laws of Nature Change?*

In discussing the problem of induction, one may hear the proposal that even if there have been natural laws in place up until now, how do we know they won't change? This suggests another argument for the contingency of our laws of nature. First, consider a world like ours up to some time—now, or 1968—but in which things then change, in one of the various ways we earlier described: perhaps the constants change, or the relations between properties and magnitudes

[13] It might be claimed that 'gravity' is nonrigid, so that even though the force would be gravity, this doesn't show that the *gravitational force* itself might have been different. This, however, doesn't seem to affect the claim that while the law is that objects gravitationally attract each other with a force of $[(6.67\times10^{-11}\mathrm{N}\star\mathrm{m}^2/\mathrm{kg}^2)\ \mathrm{mm}']/\mathrm{r}^2$, that might have been false.



change. At any rate, aspirins cease to relieve headaches, instead causing rashes; straight contact causes angular motion; shadows don't have the shapes of their objects—and none of this is due to different forces. Things just happen differently—though with as much claim to law-likeness as before. We may suppose that, for a while, scientists try to hold onto the old laws and explain these changes by extra parameters, but they ultimately decide—correctly (why mightn't they be right? Let our world be one where they are)—that they would do better just to look for what new equations could account for events since the change. And indeed, they are there to be found.

Now, how are we to describe such a world? There seem to be the following options: (a) A natural description is the one with which we started: the laws changed at t. If this is right, we immediately have the contingency of our laws—if the necessity of a law is supposed to imply its *always* holding (as opposed simply to its holding in every possible world, at least at some time)—or we can get there by imagining a world just like this world, except only *after* t, so that our laws are *never* in force. (b) One may insist that laws are incapable of change. If so, one may try the claim that there are laws, but they are more complex than our laws—perhaps they make reference to a particular time: for example, instead of '$F = Gmm'/r^2$',[14] we have 'at $t < 1968$, $F = Gmm'/r^2$, at $t > 1968$, $F = G\star mm'/r^2$', or whatever. On the other hand, one may deny that this could really be the form of a law, saying instead that there would be no laws in such a world.[15] Either way, our laws clearly do not obtain here, so we again have conceived the possibility of their failing to obtain. (c) A final possibility here is to maintain that the laws in this world do not change, but that the properties, magnitudes, and forces that appear in the world before t, and that *seem* to still be around after t, really cease to be instantiated after t; instead, there are 'look-alike' properties, and so forth. Consequently, the same laws hold throughout, but before t, half have no application, since the properties they govern have no instances, and after t, the other half (ours) are in that position. This view will presumably be attractive only to those already invested in the claim that the laws of nature hold necessarily, so my reply will wait until section 3. For now, we may simply note that it sure *looks* like we have the same properties—hitting an object at an angle of 42 degrees, moving at 5 feet per second, accelerating at 32 feet per second$^2$—so this at least looks like a situation, however described in accord with either (a) or (b), in which our laws fail to obtain.

[14] This is the law of gravity. F is gravitational force, G is the universal gravitational constant, m and m′ are the masses of the attracting objects, and r is the distance between them.

[15] See David Armstrong for both of these options (1983: 100–1; 1993: 147–8).

## 1.4 *Mini-Worlds*

We can imagine the world being very short, or very small—one object for one second, one object changeless throughout, a time-slice of the actual world, preceded and followed by nothing, to name a few. Need we suppose that in all of these our actual laws obtain? Of course, setting aside probabilistic laws (see above, and notes 10 and 11), if actual properties and forces, and so on are instantiated, with nothing extra, then these worlds constitute examples of the sort considered under (1.1) above—if there is a ball made of concrete, and the next moment nothing, or if the ball is moving at 3 miles an hour and then just stops, and neither of these is due to extra forces, then our laws can't obtain there. The briefness of the worlds' histories just helps make this vivid.

But there is another point here, which will lead to our last argument. Doesn't it seem gratuitous to suppose that in such worlds there are *any* laws, or at any rate, any laws rather than any others which are equally compatible with the few events in our world?[16] Or, put a bit differently, if we *can* understand the claim that there are laws in such worlds—for example, that there is a factual (and not trivial or definitional) answer to what would have happened had the world continued—can't we make equally good sense for *any* candidate law, that there are mini-worlds just like ours in its history, but in which this other law is in place? If so, once again, we have worlds in which our laws fail to obtain, either because there are no laws,[17] or because there are alternative, incompatible laws.

Now, this last question raises the more general question of whether the laws of nature in a world supervene upon its history. Classic regularity theories imply that they do, while more recent views, most notably the view that laws

[16] As Tamar Gendler has pointed out to me, and as Fine notes in his chapter, our laws may imply that at least some of these worlds are actually physically possible. In such cases, clearly, it is not gratuitous to say of these worlds that they obey our laws. But (1) not every such world will be so physically possible, and (2) we have to be careful about what is or is not gratuitous here. When we say 'the world could have had this history,' we may be making a claim of either nomological or metaphysical possibility. When making the former, of course, we are accessing a world—if there is one—that shares our laws, and so it is not at all gratuitous to say of that mini-world that it does so. But if we are—as I was—making a claim of metaphysical possibility and just describing the world with no implicit legal baggage, the question is whether the description as so given requires our laws to obtain. And that is why I call the supposition of a particular set of laws here gratuitous: given that we aren't constrained by 'physical accessibility', we want to know what *in the history and contents of the world itself*—for this is all that has been specified—gets us one set of laws rather than another. But this anticipates (and leads to) the argument of the next section.

[17] Those who prefer 'no laws' might propose that it can't hurt to assign our laws to such worlds, insofar as what happens there doesn't contradict them. But while we can agree to say this, it hardly makes it *metaphysically* so—indeed, the claim *is* that *really*, there are no laws.



of nature are relations between universals,[18] would suggest that they do not. For the most part, I have tried to make my examples acceptable, whatever account of laws one accepts. But at least the most recent argument is not so neutral—if worlds cannot differ in their laws without differing in what happens at the worlds, then I cannot argue that for each mini-world there are actually a plethora of possible worlds differing in their laws. On the other hand, if the laws *are* supervenient, we return to the somewhat doubtful content of ascribing any laws—but more specifically our own—in the mini-worlds. However that may be, we may use the issue of supervenience to pose one final argument.

## 1.5 *Do the Laws of Nature Supervene on the History of a World?*

Laws of nature either exhibit what has been called 'Humean supervenience' or they do not. As characterized by David Lewis, Humean supervenience 'is the doctrine that all there is to the world is a vast mosaic of local matters of particular fact . . . there is no difference without difference in the arrangement of qualities. All else supervenes on that.'[19] According to this, laws of nature would so supervene, so that pairs of worlds differing in no local matter of fact could not, then, differ in their laws. This view has come under regular recent attack, but is still fairly commonly held; I will argue that, either way, we have a clear case for contingency.[20]

If laws of nature don't supervene, it is quite easy to imagine them otherwise and, especially, in a way fully compatible with the magnitudes, properties, and the like, that are actually governed by those laws nonetheless being instantiated. On the most standard non-Humean view, laws of nature are relations among universals (see note 18). But without supervenience, these relations are not determined by the actual distribution of instantiations of the governed properties—indeed, the relation, if anything, is supposed to be explained in the other direction. But, as is well known, any number of imaginable laws—conceivable relations among universals—could, if actual (combined with the actual initial conditions, if any), produce just the actual history of the world. Indeed, this is generally noted as a possible problem in theory selection, and for some Humeans, as a problem in giving real content to the claim that one rather than another of these sets of laws is the actual one. So, there is nothing to imagining a world where the laws of nature are different—imagine a world *just*

[18] This view is sometimes called 'the Dretske–Tooley–Armstrong view', after its early proponents. The classic citations are Dretske (1977); Tooley (1977, 1987); and Armstrong (1983).

[19] Lewis (1986: pp. ix–x).

[20] See, e.g., Carroll (1990, 1994), as well as the writings cited in n. 18.

*like ours*, so far as its particular history goes, but differing in the relations among universals, or, more neutrally, differing in the laws in virtue of which this history comes to pass. Notice that this is equally vivid, if not more so, for probabilistic laws.

So, what if the laws *do* supervene? Actually, for the most part, those who think that the laws *do* supervene are the least likely to think them metaphysically necessary, since the laws, in a way, do not so much *explain* the history, as sum it up or organize it. Be that as it may, we have an independent, and equally straightforward, reason to think that the laws could have been different within this view—just imagine the history different. Now of course, it isn't *so* simple—not every alternative history is incompatible with the actual laws. But it is easy enough to select one that is, and we've seen various samples above. What is useful, I think, in viewing those examples from the current perspective is the idea that in imagining them, we *thereby* imagine the laws to be different, in a way that is perhaps more direct than if we think that when considering these cases, we imagine the laws to be different only by implication.

So, the laws supervene or they don't, and either way leads pretty directly to plenty of conceivable ways in which our actual laws could have failed to obtain.

By now, you have no doubt had enough. Yes, we can imagine that our laws of nature do not hold. So what, then, of those who think the laws are nonetheless necessary? Surely, they have not overlooked the fact that we can imagine their failing to hold! Rather, we can expect them to maintain that here is a case where conceivability and possibility come apart: we should discard this evidence, and embrace the laws as a posteriori necessities.

## 2 Necessity A Posteriori

As we noted earlier, most philosophers now believe that there are necessary truths that can be known only a posteriori. The standard examples are empirical identity statements (where both terms are rigid designators), like 'Hesperus is Phosphorus' (ordinary identifications like 'That's Joe!' are less-discussed examples, but more indicative of the pervasiveness of such truths) and scientifically discovered property identifications (and their logical consequences), like 'Water is $H_2O$' (and 'water contains hydrogen'); also commonly offered are truths of kind membership—'Lassie is a dog' (this is not a priori—we could discover she was a very weird looking pony) and 'Cats are mammals'—and more controversial statements of material origin, like 'Queen Elizabeth originated in sperm s and egg e'. In each case, there are arguments that these truths are necessary, despite their not being knowable a priori. But, in not being so knowable, they are all, like our laws of nature, subject to conceivable falsity: we can—or can seem to—imagine that Lassie was a pony, and that Superman was not Clark Kent. Since these conceivings are compatible with the truths' nonetheless being necessary, perhaps the laws of nature are in the same boat.



Unfortunately for the necessitarian, this is not, I believe, a metaphysically interesting boat. I have argued elsewhere (see note 4), that each necessary a posteriori truth should be seen as derived from a combination of an analytic principle of individuation that has empty spaces to be filled in by empirical findings and a particular empirical finding that of itself carries no modal weight. For example, in the case of water's being necessarily $H_2O$, the analytic principle might be 'Nothing counts as water in any situation unless it has the same deep explanatory features (if any) as the stuff we call "water" ', and the empirical fact, which makes the result a posteriori, is that the deep explanatory feature of the stuff we call 'water' is being composed of $H_2O$.[21] It is clear that each argument for some necessary a posteriori truth, if successful, establishes some such more general principle, and in each case, the argument looks a priori—we establish a priori what (sort of) empirical fact will generate a necessary truth, and empirically discover the particular fact. The modal force, then, of necessary a posteriori truths comes from the principles, which we have compelling reasons, I think, to treat as analytic and as representing linguistic conventions, rather than as revealing metaphysically deep features of reality.[22]

My arguments for this last conclusion were epistemological, metaphysical, and semantic.[23] Epistemologically, short of postulating a mysterious faculty of intuition, the only way to understand how our a priori methods—principally, thought experiments of the sort described above—could give us knowledge of these principles is to suppose that they reflect the meanings we have attached to the relevant terms, like 'water', 'natural kind', and singular terms.[24] Metaphysically, it is hard to see what real necessity could *be—especially* when we consider that for each necessary a posteriori truth, there is a genuine possibility which is *just what* the negation of that truth would be like, except that it requires a different description. For example, while there is supposedly no world in which water fails to be $H_2O$, there are worlds in which stuff other than $H_2O$ does basically what water does, and occupies the roles that water does here. But one might have thought that if water's being necessarily $H_2O$ was a

[21] For fuller discussion, see Sidelle (1989: Ch. 3). Similar accounts have been offered by Frank Jackson (1998) and David Chalmers (1996).

[22] [For related discussion of these issues, see Chalmers, Ch. 3 above, and Yablo, Ch. 13 below—eds.]

[23] See Sidelle (1989: Ch. 4, as well as 1992*a* and 1995).

[24] On this last, see Sidelle (1992*b*).

real metaphysical necessity, it would at least have to rule out situations like that. If not, what erstwhile possibilities *does* it rule out? It only rules out that this stuff can be water—but we might wonder if that can really amount to anything more than that, given the rules of English, we cannot *call* it 'water'. And this leads to the semantic argument: given these other genuine possibilities, it is easy to imagine that people just like us, given all the same information, introduce proper names, 'water', and the rest in just the situations we introduce them, with no other conscious thoughts than we have—but who offer different judgments and descriptions of the possible worlds that we use as our main arguments for the necessity of some a posteriori truth, and who are not moved by whatever further considerations we offer.[25] For example, they say XYZ *is* water, and Jimmy Olson's pop *would* be Superman[26]—and they continue to do so in the face of whatever we may say which we have found convincing in favor of our alternative descriptions.

Argument one: Isn't it much more plausible to say that they are employing the relevant terms differently than we are, than to say that they are simply wrong? They have associated different criteria of individuation with 'water'. But then, what makes 'water is $H_2O$' necessarily true in *our* case is the fact that *we* have associated particular criteria with 'water'—and that is to say that the general principle is analytic. Argument two: In order for 'water is $H_2O$' to express a necessary truth (and so, for dissenters to be wrong), 'water' must refer to $H_2O$ rather than, say, 'functional kind W', or, as some call it, 'Thwater'. How can it do so? Since every actual instance of water is an instance of thwater, it can't be just because the stuff we call water *is* necessarily $H_2O$—for these samples also instantiate something that *isn't* necessarily $H_2O$. There must be something in our intentions in using the terms—exhibited in our judgments of what counts as water in various counterfactual situations—that determines one rather than another as the referent. But then it is not the fact that 'this stuff' is necessarily $H_2O$ that makes our counterfactual judgments true but, rather, our counterfactual judgments that determine that we are talking about a sort individuated by deep structure rather than (say) functional features. So again, it has to be built into the meaning of the term that this is how to apply it counterfactually—and again, the general principle is analytic, and the necessary truth reveals our linguistic conventions, not any metaphysically deep essential feature.

[25] We don't need to imagine such people—they are actual.

[26] There are two interpretations of this latter: one is that 'Superman' is not being used as a rigid designator; the other is that it is being used rigidly, but the associated criterion of identity is not that for persons: Superman is constituted by different people in different worlds.



Of course, one may argue that, for all this, it is nonetheless true that there *is* a real kind whose deep metaphysical essence is 'being composed of $H_2O$', and that all my argument shows is that we cannot refer to this kind without certain referential intentions, and that if we had different intentions, we would have referred to something else. But this is gratuitous: once it is granted that the general principle is analytic, we have an explanation of the necessity of 'water is $H_2O$', and of all the evidence in support of this, which doesn't posit any such metaphysical essence—beyond, perhaps, the logical necessity of $H_2O$ being $H_2O$—and this is all to the good, given the further epistemological and metaphysical puzzles.

This, then, is my general take on necessary a posteriori truths. If I am right, much of the rhetoric that has gone with, and followed upon, the acceptance of such truths involves misinterpretation. Metaphysically, it is misleading to speak of essences and natures, as if they were more than semantically determined; by the same token, it is at best misleading to say—as many philosophers often do—'well, of course you can imagine that a is F, or some F is G—but perhaps *the very nature* of a, or F, makes this really impossible'. This is especially important, because this sort of 'real natures' talk is often what underwrites the sense that considerations of what we can imagine should not be expected to shed any light on what is genuinely possible. If 'real natures' are properly understood according to my account, no such suspicion of the epistemic force of imagination is warranted—it is just that we sometimes need to try to imagine something on an assumption (i.e., that it is in fact false), because only so will it reveal the nature of our conventions. And of course, we have independent reason here to think that any such conclusions, suspicious of imaginative appeals, start by underappreciating the role of these very appeals for necessary a posteriori truths themselves—all the modal work, epistemically, is done by traditional a priori methods, not science.[27] And so, as I said earlier, not only is a general suspicion of imaginative appeals *unwarranted* by, but it is actually *inconsistent* with, taking these very necessary truths to have been successfully argued for.

If the laws of nature are necessary in *this* way, their necessity, too, would not be of the sort its advocates seem to have in mind. And insofar as most of the above arguments apply to necessary a posteriori truths *by their nature as a posteriori*, and not simply because of details of the actual cases (though that helps make things even more vivid), I think they must apply to any such truth, and so to laws of nature, if, indeed, they are necessary at all. But rather than just stand

[27] For more along these lines, see Bealer (1987).

on this, let's look at the actual arguments, and see whether they can establish a necessity for the laws of nature beyond the convention-based sort we've been discussing.

## 3 The Purported Necessity of the Laws of Nature

There have been two major sorts of argument advanced in support of the necessity of laws of nature. The first, and more common, uses the fact that laws of nature carry modal weight, both directly and in the fact that they support counterfactuals, and argues that the only way to understand this is in terms of the broadest metaphysical necessity of the laws.[28] The second argument looks not directly at laws of nature, but at the properties governed by the laws.[29] Properties—or, at any rate, *these* properties—must be individuated by their causal powers, and these are precisely what are specified by their governing laws. Thus, these properties cannot fail to be governed by these laws, so our laws at least obtain in every world where these properties are instantiated[30]—a strong enough conclusion—and one might think that it at least doesn't hurt to say that the laws obtain even where the properties are not instantiated: after all, given the nature of the properties, all the counterfactuals entailed by these laws obtain—for example, if this object *did* have positive electric charge, it would do such-and-so (this counterfactual has to be true if positive charge is, as the position maintains, individuated by all its causal powers). I will look at each of these arguments in turn, and try to show how either the position, or the argument for it, founders when considered in combination with the conceivings presented in section 1.

First, the argument from counterfactuals. Even if we grant that laws of nature support counterfactuals and claims about what 'must', in some sense, happen, it seems, at first glance, hardly to provide a basis for the broad necessitarian claim we are considering. After all, many opponents of the position are happy to grant a sort of natural necessity to laws of nature or, at least, to the events they govern—why do we need anything stronger? And true counterfactuals always seem to coexist with *some* worlds where the antecedent is true and the consequent false—that's why counterfactuals are typically interpreted

[28] See all the writers mentioned in n. 3, other than Shoemaker.

[29] This argument is most famously associated with Shoemaker, but a version of it is also offered by Swoyer.

[30] As Elliott Sober pointed out to me, this argument does not apply to noncausal laws.



in terms of what is true in worlds *close to ours*, when the antecedent is true, instead of requiring truth in *all* such worlds.

However, it is maintained that we cannot understand the law-supported counterfactuals—with the force they have—short of supposing that their consequents are true in *every* world where the antecedents (and, of course, other causally relevant facts) hold. Similarly, if there *are* worlds where, say, I let go of the ball in just these conditions and it doesn't drop, then there is no acceptable way to accommodate the claim that it really *has* to drop.

The argument goes something like this: if there are worlds where the ball drops, and worlds where it doesn't, how is its dropping necessary *at all*? How does it differ from any other fact that obtains in some, but not all, possible worlds? Perhaps, one might try, it is an instance of something that always obtains in the actual world—but now we have the problem, which the modal force of laws was supposed to address, of distinguishing between laws and accidental generalizations. The latter also always obtain, and do so in some but not all other worlds. And if one interprets the necessity as truth in all worlds where the laws of nature obtain, there is still no difference from accidental generalizations, since it is true in every world where all the coins in my pocket are nickels that, if I have a coin in my pocket, it is a nickel. If the sort of necessity in question is just, in effect, truth in all worlds where some (actually) true generalization obtains, *every* true generalization supports such necessities. Since instances of laws have some more *robust* sort of necessity, their necessity cannot be understood in a relative, partial way.

The very same considerations apply to the counterfactuals that laws support. It is natural to say that what is strictly true is that, if I were to drop it, the ball would fall *in all worlds with the same laws as our world has*, and when we count the counterfactual true *without* the qualification, it is because we are holding the laws of nature fixed, or, if one likes, treating similarity in laws as required for a possible world to be sufficiently close for evaluating the counterfactual. However, here again, *any* fact—in particular, accidental generalizations—will support counterfactuals if they are held so fixed; if, to be acceptably close, a world has to be one where all the coins in my pocket are nickels, then it is *true* that, had there been another coin in my pocket, it would have been a nickel. If the way in which laws support counterfactuals is not of this trivial sort—which it must not be if laws support counterfactuals and true accidental generalizations don't—it can only be because there *is* no restriction: the consequents are true in *every* world where the antecedents are true.[31]

[31] Here is Fales's presentation: 'So it is with law-supported counterfactuals. Conventions have a role here, too. They tell us, roughly, to hold fixed all causally relevant aspects of a situation

There are a number of replies to this interesting argument. The first is that it is simply not clear that the modal and counterfactual-supporting force of laws of nature is as objective as proponents of this line suggest. It isn't clear that we really *can* suppose that counterfactuals have determinate truth-values short of an at least implicit complete specification of the antecedent which entails the consequent—so the necessity would just be logical and hypothetical. It is also hardly mysterious that, in general, our counterfactuals would hold the laws of nature fixed; while it is a convention, it is a deep convention.[32] The laws of nature are among the most general, pervasive features of the world, and provide the basic terms in which we couch our explanations. Given our general purposes in asserting and asking counterfactuals, one would expect the assumption of common laws. Of course, this reply needs a way of distinguishing laws from accidental generalizations *other* than by their independent support, or lack thereof, of counterfactuals. But it isn't wholly clear that our confidence in particular counterfactuals *is* independent of our views about what the laws are, so this does not seem a hopeless project. But I won't pursue it here.

A second point is that, whatever the force of the claim that laws support counterfactuals and have modal force, we have already presented at least prima-facie grounds for thinking that they are not necessary in the widest sense, that there are possible worlds where the antecedents are true and the consequents false, and where the events that 'must' happen *don't* happen. Thus, the postulation of metaphysical necessity for laws seems to prove too much—it may offer an explanation of what we want explained, but it has other entailments that seem false. This, of course, is the basis for the traditional idea of nomological necessity as a weaker sort of necessity. But, according to the argument at hand, we can't really understand such a middle modal status: anything weaker than real, full-blooded necessity will leave the laws in the same position as accidental generalizations that don't have modal force or support counterfactuals.

Why should this be? Most of those who take the necessity of laws seriously are anti-Humeans who advocate causation as some sort of natural necessity.[33]

except those to be counterfactually varied. But they could not instruct us to "hold fixed" the supporting law itself. Were they to do that, the truth of the counterfactual would become a mere artifact of convention (as, for example, it would be if we were to claim that accidental generalizations support counterfactuals in virtue of some newly laid-down convention that fixes the accidental generalizations themselves). To objectively ground a counterfactual, a law must itself be necessary. Only thus will what happens in worlds whose antecedent conditions differ from ours be a matter of objective and determinate fact' (Fales 1993: 128).

[32] See Armstrong (1993: 146).

[33] Other Humean opponents would be friends of real, probabilistic causation, but they, of course, would hardly be giving this argument.



Now, isn't the apparent fact that such connections are *not* necessary in some broader sense *of itself* sufficient grounds for thinking that there is some such notion to be made sense of? The attempts made, by Fales and others, to consider how something short of metaphysical necessity could be adequate are all of a distinctly Humean stripe—they don't postulate some weaker sort of necessity, but instead try to explain the apparent necessity in terms of *logical* relations given certain assumptions. But why suggest something so deflationary? If one thinks this necessity is something real, let's get it out there! Why can't the 'force' of causal necessitation determine an accessibility relation, in virtue of which the relevant counterfactuals hold? We don't need to think of all the possible worlds as self-contained little units only possibly related by similarity—the laws of nature give us (physical, or whatever) access to some, but not all, metaphysically possible futures, and so to some, but not all, worlds. Why isn't this a basic sort of relation among worlds that binds some together in a way that not just *any* similarity does? This, at any rate, *seems* to be what postulating genuine natural necessity amounts to; and, if so, it gives us both a restricted sense of necessity that is not trivial and objective support for counterfactuals that isn't afforded by just any true generalization. I don't mean to advocate this view—I tend to the first reply—but *insofar as* one rejects Humeanism, and is willing to postulate natural necessity, why can't it be some such weaker postulation? And if it can, isn't it preferable to the stronger claim—not merely because it is weaker, yet sufficient, but because it is consistent with the rest of our modal evidence?

This brings me to my third, and most important, reply. It seems to me that postulating metaphysical necessity here cannot really serve the purpose of explaining the truth of counterfactuals *in the way* its proponents maintain they need to be explained to have adequate objectivity. To make this point, we need to first recall our imagined worlds of section 1, and consider what the friend of the necessity of laws of nature can say about them.

The standard line, following Kripke in *Naming and Necessity*, maintains that in our conceivings we have established *some* possibility; but when what we imagine, or seem to imagine, is genuinely impossible, we have misdescribed the actual possibility. So, for instance, our purported imagining of Hesperus not being Phosphorus gets at a genuine possibility: namely, that the first celestial body visible in the morning—which, in the situation, we call 'Phosphorus'—might not be the same as the first celestial body visible in the evening—there called 'Hesperus'. In one such situation, we would actually be naming Hesperus 'Hesperus', and in another, Phosphorus 'Phosphorus'—but we can't, in either, be giving *both* names to their actual world referents. Similarly, in apparently imagining non-$H_2O$ water, we are cottoning on to the real possibility of

differently constituted stuff behaving just as water does and occurring in just the same situations—but that stuff is not, in fact, water (assuming we agree that water must be $H_2O$).[34] Call this the 're-description' approach.

How would that be applied here? The proper description of these worlds must be such that our laws actually do obtain there. Since the laws and events we have described are at least not in *accord* with our laws, it could only be because the properties, magnitudes, and so on instantiated in these situations are not *our* properties, magnitudes, and the rest—so our actual laws can still obtain, although in most of our cases, vacuously. (This is the approach we put off considering in section 1.3(c).) Unfortunately, this will often be of dubious plausibility. Is the angle at which this light hits this object not 42 degrees? Is this ball not moving with a velocity that, according to our actual laws, must lead to the other ball's moving off in a way other than it does in our imagined case? If objects attract each other with a force not governed by $Gmm'/d^2$, is this force not gravity? Or must we have mistakenly assigned masses to the two objects? Or mistakenly identified the distance? I think that 'mass is wrong' is the only move with a prayer here, but even it looks implausible if we imagine the quantity to still be governed by other actual laws, such as $F = ma$. Perhaps some other imaginings can be more plausibly re-described, especially when the concepts in the laws are sufficiently theoretical—maybe when we think we imagine nonradioactive radium, there is good reason to say we haven't really imagined radium, because it must have this atomic composition, and that is ultimately what radioactivity *is*. But it seems implausible as a general rule.[35] Consequently, at least some of our examples cannot be plausibly re-described, and those laws, then, still seem contingent.

But suppose we try to gain strength from our argument. It is a law that objects attract each other with force $Gmm'/d^2$, and so we have true counterfactuals of the form 'if the mass of the Earth swelled to M, then it would attract

[34] I have adopted Kripke's description of these situations as only seeming imaginings of impossible situations, and in fact genuine imaginings of possible situations, which are wrongly described (Kripke 1980: 102–5, 113–14, 124–5, 128–55). If one prefers Putnam's claim that we can conceive of the impossible, one can delete my use of 'seeming' or 'apparent' as applied to these conceivings; it remains that for each impossible situation we can imagine, there is a (or a set of) corresponding *possible* situation(s)—so that even if it is possible to imagine the impossible, there is always *some* possibility genuinely established by the imagining.

[35] As will become clear, nothing in the main argument *depends* on this—the natural necessities that are 'fully' necessary are, by my account, conventionally, not 'metaphysically', so, even if *all* natural necessities are absolutely necessary. It just seems to me that in a fair number of these cases, our handle on the contents of our imaginings is pretty unproblematic—which is why the 'concession' about radium doesn't seem to license a general claim that we may always be wrong.



Venus with force F'—and whatever other dire consequences. The claim is that we can only understand this as objectively true if in every world where Earth has mass M (and all other actual causal factors are the same), the attraction is F. So, in worlds, like some of those we imagined, where the attraction is *not* F, we *have* to reckon that either the mass of Earth is *not* M, or else that the attractive force is not really gravity.

Now, in effect, I have already responded to this. But there is a deeper point I want to make. Suppose, in order to maintain the counterfactual-support argument, we allow these re-descriptions of our imagined worlds. Still, *even the re-described worlds undermine the counterfactuals, if they are supposed to hold with objective, absolute necessity*. Remember, one of the key ideas is that laws are supposed to support counterfactuals in an objective, nonconventional way. It is the internal nature of the workings of the world, not what we tacitly build into our descriptions, that is supposed to make these true. And so much as a single possible world where the antecedent obtained without the consequent would, on this view, undermine the necessary objectivity. But look at the world we have now been forced to re-describe, or any such world that seems to violate the counterfactuals supported by our laws. Do the re-descriptions undercut the fact that things could be, in all relevant respects other than the supposed identity of these particular properties, exactly the same, while events took a different course? It is *this* that, it seems to me, has to be impossible according to the counterfactual-based argument—but it is not. The 'impossibility' in question seems just a matter of linguistic decision—failure to satisfy this counterfactual, and that *alone*, will suffice for this to be a different property (or, to not satisfy this predicate)—and this undermines the supposed objective, metaphysical force which the postulation of metaphysical necessity was supposed to vouchsafe for the counterfactual. We may re-describe all the properties and quantities we want—if the re-described possibility is genuinely possible, then, while the counterfactual may be exceptionlessly preserved in letter, is has not been saved in spirit.

Put this another way. Suppose we ask, 'Why doesn't Earth, when not attracting Venus with F, have mass M?'—or, more generally, 'Why doesn't a have property p/magnitude m (but only p*)?' The only available answer is: 'Because then it would obey these laws, which it doesn't.' Then it is the fact that the counterfactuals fail—and *simply* that fact—that determines the magnitude, rather than the other way around. If anything *else* about m determined these counterfactuals to be true, they would have to be true for our 'alternate' quantities as well. But we see that they are not, and describing our imagined properties or quantities as other than our actual properties or quantities cannot change this fact. It is *simply the failure to satisfy the counterfactuals* that drives the

re-description, and this undermines the pretext that it is the 'nature' of the properties themselves, given the laws that actually govern them, that rule out *any* possibility of the holding of the antecedent without the consequent. (This is perhaps clearest if one considers the examples of the laws changing over time (section 1.4).)

Thus, since the re-description of our imagined cases undermines the supposedly needed force of the counterfactuals, I conclude that our cases show that counterfactuals just *don't* have that force, and thus that this argument cannot show that laws of nature are necessary a posteriori. Notice the similarity between this argument and the metaphysical (and semantic) arguments for my rejection of a 'realist' reading of the more familiar necessary a posteriori truths—in both cases, there are acknowledged genuine possibilities that undermine the supposed force of the purported necessity. The difference is that in those other cases the re-descriptions are independently plausible, while they are not, in general, so here. Thus, the case for re-description here requires argument, and the current argument requires—what is *not* needed for the more familiar necessary a posteriori truths—that the postulated necessity be real, rather than conventional. Since this it cannot be, I conclude that, rather than a case for (what would be a) conventional necessity, we have no case for necessity—beyond perhaps natural necessity—at all.

Things are a bit different when we turn to the other argument, the argument from the causal individuation of properties. Here, I think, we *do* find some reason to think that at least *some* laws are necessary. But, I will claim, we have as much reason to reckon these necessities as convention-based as we do the more familiar necessities a posteriori.

Why should we think that properties governed by laws must have the causal powers ascribed to them by these laws? Here is one fast argument: if we have already accepted truths like 'water is $H_2O$' as necessary, it is presumably because we are individuating substances by their deepest explanatory features. Well, don't laws, in general, tell us things' deepest explanatory features? And what are the 'explanatory features' of a property, or magnitude, other than its causal powers—or anyway, that in virtue of which it has its causal powers?[36]

The force of this argument will vary greatly with how one has interpreted the necessity of water's being $H_2O$. If one has given it a realist reading, it

[36] Some properties, like being a bachelor, or being grue, would seem not to actually be individuated by their 'deepest explanatory features'—but Shoemaker would maintain that this is because they aren't law-governed at all (as such), and so, by his lights, are not genuine properties (I'm not entirely sure whether he would accept this for bachelorhood) (1984: 207–9, 219).



may look quite compelling. But, on the interpretation I have given, it has limited force. First, and most obviously, since it is just an extension of the earlier arguments, it would at best establish the sort of convention-based necessity for laws of nature that we have found applies to the earlier necessities; all of the earlier arguments would apply with equal force, with the semantic and metaphysical arguments applying because of the cases we discussed in section 1. Those worlds would fail to be worlds where our laws didn't obtain *simply* because our conventions require that we describe them so—that we say the properties, magnitudes, and so on are not our properties, but look-alikes—'schmass, schlight, scharge'. But second, insofar as the necessities *are* dependent on our conventions, we cannot just assume that all our scientific terms are governed by the same sorts of conventions. Maybe some explanatory features count for more, in identifying this or that property in another situation, than another, for any number of reasons.[37] We need, basically, to conduct the relevant thought experiments. Insofar as most of the terms in laws are theoretical (though see some exceptions below), and (I think) we as laymen defer to the experts in their use,[38] then we would need to have practicing scientists perform the relevant thought experiments before we could determine which causal powers (and so, laws) are, and which are not, necessary a posteriori. However, there is no doubt good reason to think they *would* re-describe quite a few of our sort of cases, and so, by implication, judge many causal powers, and so laws, to be so necessary. And so, we have here, I suspect, good reason to think at least some laws *are* necessary a posteriori. But again, the results would just show us how scientists use the terms, and the necessity would be based in analyticity.

There is one more argument here that doesn't seem to be just an extension of the traditional arguments, and hence is a candidate for showing us that

[37] This addresses an argument Shoemaker gives (1984: 228–30). Of course, Shoemaker *is* there assuming that the causal necessities are metaphysical, and so reasonably asks how some, but not all, causal powers can be necessary. But, having already addressed his charge that conventions cannot make for *de re* necessities (Sidelle 1989: ch. 3), we have the wherewithal to see how there could be discrimination here.

[38] That is to say, if we are asked the relevant counterfactuals, and it is built into these that scientists would judge the cases other than we might have been inclined to, we will go along with the scientists. Insofar as we do, that is part of our referential intention in the use of the term, which goes into the necessity-determining analytic truth. It may be urged that in these cases, our imaginings are no guide to possibility—but this would be a mistake for two reasons. First, it is our imaginings which indicate the modal significance of the scientists' judgments, and second, they still establish *some* possibilities, which possibilities form the basis for our arguments against the *metaphysical* significance of the necessities that we will accept from the scientists' judgments.

laws of nature are broadly necessary in a really metaphysical, not conventional, way. This is Shoemaker's argument, which he calls 'broadly speaking, epistemological',[39] though it has a metaphysical side. Suppose, Shoemaker asks, that properties could differ in their causal powers.[40] Then, two properties ought to be able to 'switch' their causal powers, either across worlds or across time.[41] But this, Shoemaker contends, is incompatible with the fact that we often know what properties things have, and that some object has continued to have some property over time. Both these results stem from the basic, and obvious, fact that we know what properties objects have in virtue of the causal powers these properties confer—either causal powers to affect us, as in being green or round, or to affect other things, getting to us more indirectly, as in having a mass of 2 micrograms or containing two free electrons. The time argument is easy—if we know that a is F due (directly or indirectly) to the causal powers of a, conferred upon it by F, but property G could come to confer those powers while F loses that ability, then the apparent absence of change in a, with respect to F, could be due to a's coming to be G, while F and G have switched roles. So how can we ever know, for any a and F, that a is still F? In the case of properties differing across worlds, the argument is this: we believe that a is F because of some sort of causal interactions between a and whatever. But if being G could produce those same results, how can we tell that a is F, rather than G? Of course, when the overlap is only partial, we can conduct other tests to discriminate. But when being F or being G will produce just the same results in *any* circumstances, no test *could* distinguish. And lest one say that this is only a problem in worlds where F and G *do* confer the same causal powers, we can note that we seem devoid of resources for telling that we are not in such a world; that is, while there are some properties that we know don't confer the same powers as other properties, there could always be two, or lots of, properties with the causal powers in virtue of which we believe that a is F. On the more metaphysical side, the very possibility is supposed to be disconcerting; surely we have *some* way of identifying properties across worlds, and if there could be such complete switches of causal powers, how is this possible?[42]

As interesting as this argument is, it is in another way quite perplexing. One would *think* that taking it seriously might start us worrying whether we really *do* know that objects have retained their properties, or that a *is* F (where F is not

[39] Shoemaker (1984: 214).

[40] A causal power of a property is to be understood as a power conferred upon objects with that property to bring about P in conditions C, where C includes the instantiation of other properties.

[41] For further discussion of these matters, see Hawthorne, forthcoming.

[42] For something like this metaphysical argument, see Swoyer (1982: sect. II).



itself trivially identified causally: for example, 'has the power to make me feel pain'). Is our confidence that we know these things greater than our confidence that pairs of properties couldn't—or don't—switch their causal powers? If we came to learn that there in fact is—or is even a suspicion of—a property G just like F except in the causal powers it confers in cases quite unlike those that any of us encounter—it would hardly be to the point to insist that we often know that some a is F, so there really can't be any such G. To dismiss this purported G, we would need independent grounds, and if we were to uphold our knowledge of F without such a denial, it would have to be on some sort of *epistemic* grounds. While Shoemaker might insist that the cases differ because we could at least in principle distinguish this F and G, this doesn't seem relevant to the apparent need for either an independent argument or an epistemological solution. In short, it isn't clear why Shoemaker hasn't identified an epistemological *puzzle*, by identifying an underlying, but unnoticed and problematic, *assumption* of many of our ordinary beliefs, rather than an argument for a strong metaphysical position.

A similar point can be made by noting the similarity of Shoemaker's position with a response that might be offered to an argument associated with Locke and Kant, about personal identity. Locke and Kant point out that, assuming immaterial souls to be the seat of thought, we cannot tell, by introspection (or presumably, any other methods), that from day to day—or minute to minute—we have the same souls, *assuming that souls can 'switch' contents*. Since, it is claimed, we *do* know that *we* are around from day to day—even if these switchings are taking place—we cannot be our souls. Now, suppose that one concluded from this scenario *not* that we can't be our souls, but that our souls *cannot* switch their contents, as Shoemaker concludes that properties cannot switch their causal powers. I think we would have to say either (a) that we can clearly see that they *can*, or (b) that insisting on this just in effect *defines* 'souls' in terms of contents, and so the pretext that we know that our souls are the same from day to day simply redounds to the fact that we know that certain *contents*, or relations between contents (or whatever), are the same day to day, and insofar as one had been thinking of souls as 'that in which thoughts reside', it remains perfectly true that we don't know that *they* are the same from day to day, and sameness of person cannot be the same as sameness of that 'container'. In other words, the reply accomplishes nothing as far as preserving our previously accepted knowledge that we always have the same souls—*unless* it was just already true that we used 'soul' in the more metaphysically innocuous way, in which case the *force* of the claim that souls cannot change their contents becomes trivial—not metaphysical. Just so, I wish to say about applying Shoemaker's metaphysical solution to his epistemological quandary. Either we

*mean* by many of our predicates something like 'that which is responsible for producing E in circumstances C (and E′ in C′, etc.)'[43]—so we save our knowledge, but there is no *metaphysical* necessity to these causal powers—or we are really thinking of properties as something distinct from the clusters of causal powers, in which case we need an *epistemological* solution, for the metaphysical solution does nothing to undermine the fact that if there are these extra things beyond the causal powers, we *can't* distinguish them, and they might be distinct.

In addition, it seems clear that for many properties that figure in laws, and that Shoemaker discusses, there *are* ways of identifying them—and so, of being sure of at least some of our knowledge—quite short of *all* their causal powers. Here are some: the angles of incidence, reflection, and refraction of a ray of light hitting some surface. These all figure in laws, and so have causal powers (here I include powers to *be* caused in certain ways)—but if we identify these by their causal powers, it is only by a small subset of them: if we imagine that an angle of incidence of 45 degrees could reflect at 60 degrees, do we have to suppose that we never know that light in fact *does* hit a mirror or prism at 45 degrees? It seems just obvious that the essence—or, to be obvious, definition—of 'contact at 45 degrees', as applied to rays of light, is independent of the actual legal relations between angles of incidence, reflection, and refraction, and that 'incidence', 'reflection', and 'refraction' are also independently defined, and independently identifiable. Velocity and acceleration are another couple of central law-governed properties which seem easily knowable and identifiable aside from many of their actual causal powers.

Of course, the *way* in which these cases handle Shoemaker's epistemological problem is by being properties that *cannot* trade *all* of their causal powers with other properties, because they have features—in many cases, causal features—which suffice for being that property. But this returns us to our earliest reply, which is that these are trivial—either analytic (as in all these cases) or by being the actual values of more general analytic principles of individuation. If we can be sure of our knowledge, independent of epistemological principles, it is because we know that these features, or these causal features, suffice for something to have F—and this is because of how we use the term 'F'. Again, our examples from section 1 help make this vivid. Perhaps our use of 'mass' or 'electricity' or 'quark' makes it such that some of those worlds are best described not as worlds violating our laws, but as worlds instead instantiating 'schmass' and 'schmarks'—but that does not make these worlds go away, and the only way to

[43] By 'mean', here, I don't require that the actual causal powers be specified—we could instead, and presumably often do, have the more general 'place-holding' sorts of definitions, as that earlier suggested for 'water'.



*understand* how 'schmass' is not mass obeying different laws is by taking ourselves to be governing 'mass' by the laws, and causal powers, actually governing mass. There is no call for a more metaphysical interpretation; nor is our understanding of anything enhanced thereby.

Before concluding, it must be admitted that my arguments here—especially my assimilation of the case of laws of nature and causal powers to that of other purported a posteriori necessities—have depended on my assumption that what we can conceive is *somehow* possible; that in the case of a posteriori necessities, we have imagined, but misdescribed, some genuinely possible situation. It has largely been in terms of such situations, and their genuine possibility, that I have disparaged the purported value of postulating the broadest sorts of necessity in order to handle the way in which laws support counterfactuals and the knowledge Shoemaker cites us as having. This is, as I say, an assumption that is standardly accepted by the advocates of necessary a posteriori truths; it is implicit in the standard re-description strategy. However, there is one other strategy for approaching the seeming conceivability of the negations of these necessities, and Shoemaker himself seems to advocate it, so let me briefly comment on it in closing. Rather than allow that we have misdescribed a genuine possibility, we may give a more cavalier dismissal of the supposed imagining: So what? This doesn't admit *any* sort of possibility, beyond the merely epistemic 'This is logically compatible with what else I believe'.[44] Call this 'the dismissal'.

I think that what gives the dismissal whatever attraction it has is the idea, already discussed, that at least some possibilities and necessities stem from the real natures of things, and that there is no reason to think that our imaginations give us any special insight into this. I have already argued that we have no real conception of 'real natures', and certainly no reason to suppose there are any or that we have any knowledge of them. But even if we allowed all this, it would provide us with *no* reason to doubt the possibility of our imagined look-alike worlds. Even if we first thought them up, confusedly, as potential counter-examples to some purportedly necessary truth, we can just as well think of them directly, and insofar as we are not even *purporting* to imagine, say, non-$H_2O$ water, or a gravity-defying 10-pound object, no lack of insight into the 'real natures' of water and mass can be grounds for suspicion. But once the possibilities are so acknowledged, they undermine the pretense of real, as opposed to conventional, necessity, via the metaphysical and semantic arguments, and in some cases—like the two we have considered—they will

[44] See Shoemaker (1998: 70–4 and n. 11). Of course, I don't mean to suggest that Shoemaker advocates this for *every* purported imagining, even when the content is the negation of some necessary a posteriori truth.

undermine the argument or rationale for thinking of the proposition as necessary in the first place.[45]

Shoemaker suggests that we imagine either in phenomenal terms—in which case, we only establish the possibility of the world *looking* a certain way, or even the possibility of our undergoing a certain sequence of qualitative states—or else we do it in objective terms. 'But the more theoretical the concepts involved in such a description, the less confident we can be that there is not a contradiction or incoherence that escapes our notice' (1998: 74). I hope it is clear that many of our cases do *not* fall into the first category, and I think it is obvious that many fail to fall into the second as well. At any rate, we have already explained how it can *appear* that our imaginations are irrelevant in theoretical cases—namely, we may intend to let the experts' use of these terms guide our use. After all, they are the ones fundamentally using these terms. But even so, (1) our imaginings are still relevant to showing that it *is* scientific use which determines the proper description of the possibilities, and (2) we have no reason whatsoever to doubt that scientists equally well see the prima-facie imaginability of the scenarios in section 1—even those they are willing or inclined to re-describe—and this can hardly be attributed to their failure to understand the terms. Thus, we have all the same reasons for thinking that the scientists' use has to be understood as determining analytic rules for the use of these terms, and that their counterfactual judgments reflect these intentions, rather than real metaphysical necessities.

My main responses to both these approaches to make out the laws of nature as metaphysically necessary have focused on the fact that the existence of genuine possibilities, established by imagination, undermine any explanatory force (beyond explaining our linguistic behavior, in terms of conventions) or metaphysical punch that these supposed necessities are supposed to have. I considered other replies as well, but they are just gravy. I hope the discussion has made it apparent that this sort of reply will be available for any attempt to establish an a posteriori truth as necessary—in being empirical, there will be at least apparently imaginable cases where the truth fails to obtain, and if these cases do not undermine the claim to necessity, they will at least undermine any metaphysical pretense thereof, and show the necessity to be grounded in convention. It is seeing this that I had in mind in the introduction, in saying that I intended this investigation as a case study in the necessary a posteriori,

[45] While I have allowed that some laws are necessary, it has not been on the basis of the arguments we have considered; instead, they are established via the neo-traditional 'ask competent speakers what they would say, given the actual facts'.



and the general significance of imagination and conceivability on both the epistemology and our very understanding of possibility and necessity.

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9

# *The Art of the Impossible*

Roy Sorensen

Prize: One hundred dollars to the first person who identifies a picture of a logical impossibility. I may be willing to pay more for the painting itself. This finder's fee is simply for pointing out the picture. Let me explain more precisely what I seek.

## 1 Illegal Pictures

There is a genre of children's picture puzzles that is marked by the question 'What is wrong with this picture?' Well, that goat does not belong in the library. That clock is mirror-reversed. Ostriches do not fly. . . . The job of the viewer is to spot the incongruities.

An impossible picture features a nomic incongruity—a violation of a law. There are many pictures that depict scientifically impossible situations. René Magritte's *Collective Invention* features a reverse mermaid: woman from foot to waist, fish from waist to gills.

An impossible situation need not involve an impossible *object*. Many of Magritte's paintings feature ordinary objects in impossible *relationships*. *Zeno's Arrow* simply shows a huge rock that fails to be gravitationally related to the earth. Actually, all 'impossible objects' involve impossible relationships. For

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