IDEALLY NECESSARY LAWS OF NATURE

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I. Introduction

There are two main views regarding the metaphysical status of the laws of nature. Roughly, *Regularism* claims that the laws of nature are nothing over and above actual connections between events and between states. In other words, particular instances determine the laws. On the other hand, *Necessitarianism* maintains that the laws of nature are more than mere regularities; indeed, they are events and states that must occur as the laws prescribe. The laws determine the particular instances. Furthermore, I will refer to physically necessary laws as those that must actually occur as they do in the actual world; no modal claim is involved. This latter sort of necessity is stronger than a mere regularity, yet weaker than metaphysical necessity.

However, there is a different kind of necessity that has been neglected in the literature—what I will call *ideal necessity*. Briefly, laws of nature that are known primarily through an idealization methodology[1] hold in those worlds—and nearby worlds—where the antecedent involved in the conditional holds. These laws, then, are ideally necessary.

In the first section, I expound Chris Swoyer's defense of Necessitarianism, and also arguments from conceivability on behalf of Alan Sidelle against the metaphysical necessity of laws. Although I leave open the question of whether there are metaphysically necessary laws, I argue that this is implausible. In the second section, I describe ideal necessity by using historical examples of idealizations. I defend the claim that laws of nature discovered through this methodology are more than physically necessary because they hold in possible worlds that are not identical to the actual one, yet are not quite metaphysically necessary because there are far away possible worlds where the laws do not hold. Whether there are also physically or metaphysically necessary laws is an independent question altogether, albeit one whose answer in the affirmative does not threaten the plausibility of my thesis.

II. Metaphysical and Physical Necessities

Chris Swoyer argues that the laws of nature are metaphysically necessary relations that hold between properties. His reasons for rejecting a metaphysically contingent view of laws are twofold: 1) contingent property theorists usually suppose that laws have to come to be known a posteriori, and thus are contingent. However, Kripke showed that there are metaphysical necessary a posteriori truths, and the laws are examples of these; 2) invoking Kripke as an authority, Swoyer rejects conceivability as a guide to possibility. I will next take up each issue.

The first concern, that laws are Kripkean necessary a posteriori truths, would have to go something like the following. "Water is H_2O" is a necessary a posteriori truth because the "is" in the sentence refers to identity between two rigid designators. Laws would therefore need to also be an identity relation between two rigid designators, but Swoyer is committed to the view that laws are relations between two properties. However, it is clear that not all laws express this sort of identity; at least some laws involve one rigid designator and a property—e.g., "copper" has the property of conductivity and "electron" the property of *having negative charge* e. And because it is possible for a rigid designator to not have one of its properties in some possible world, then the claim that *all* laws of nature are metaphysically necessary, as Swoyer claims, is false.

We can ask, Is Swoyer at least right in that at least some laws are necessary a posteriori truths? Sidelle has argued against this claim on the grounds that each necessary a posteriori truth should be regarded as obtained from a blending of "an analytic principle of individuation" that contains empty spaces to be filled by empirical observation and a specific empirical observation that of itself carries no modal significance. (319) For example, if water is necessarily H_2O, then the analytic principle might be something like "Nothing is water unless it possesses the same deep explanatory characteristic as the thing we call 'water,'" and the empirical piece of information, which renders the result a posteriori, is that the deep explanatory characteristic of the thing we call "water" is being composed of H_2O (Ibid.). Sidelle claims that "the general principle is analytic, and the necessary truth reveals our linguistic conventions, not any metaphysically deep essential feature" (320).

Sidelle's conclusion appears more compelling when we consider the metaphysical arguments behind it. It is hard to see what real necessity could be when we consider that for each necessary a posteriori truth, there seems to be a possibility of what the negation of that truth would be like, except with a different description. He maintains that

> 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 [sic] a 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." (Sidelle 320)

Because the metaphysical status of necessary a posteriori truths seem diminished with this argument, then even if the laws were in the same boat as necessary a posteriori truths, the plausibility of the metaphysical necessity of laws is also weakened.

Swoyer's second concern, the nature of the conceivability-possibility link, is briefly addressed and quickly jettisoned. Swoyer contends that "we often suppose we can imagine some situation that there is, upon reflection, good reason to suppose impossible (cf, Kripke 10), and in any case there is surely little to recommend the view that what is possible is determined by our imaginative capacities" (Swoyer 210). There might be something to this. The question of whether conceivability is a reliable guide to physical or metaphysical possibility is a difficult one to answer. How are we to determine whether a certain state of affairs (not holding) is conceivable? Is it enough for one person to be able to conceive of the possibility of that state of affairs (not holding)? Is there a minimum requirement regarding the number of people that must be able to conceive of it (not holding) in order for it to be determined possible? Or must the conceiving be something akin to Descartes' "clearly and distinctly" perceiving something to be true? The link between conceivability and possibility seems shaky at best and illusory at worst. The mere conceiving of a law of nature not holding, then, is not a strong argument against the metaphysical necessity of laws.

Still, because it seems true that for any law of nature there is a far away possible world such that it does not hold, laws don't seem to be metaphysically necessary. This is so regardless of our (in)ability to conceive of any particular law not holding. Sidelle (2002) maintains that "[t]he 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" (311). Of course, we do not need to imagine or conceive a law of nature being not holding; because no law is analytic, then there is a possible world where it does not hold.

Physically necessary, or *nomically* necessary, laws are generally those considered to hold in the actual world, but don't have to hold in other possible worlds. On the view that laws of nature are relations among properties (see Armstrong, Dretske, and Tooley), say, the physically necessary laws are those whose properties *must* have a certain relation in the actual world. But these relations between properties might fail to hold in other possible worlds (see Brown).

The idea that laws are not mere regularities but physically necessary such that they could not fail to hold in the actual world is one that Armstrong, for example, briefly endorses. One reason for supposing that laws are more than mere regularities is that this supposition avoids the problem of induction. However, he does not spell out in detail the notion of physical necessity. Swoyer says that laws are usually thought to hold in "quite outré situations," and that an account of laws in terms of physical necessity fails to explain the notion of a law. (Swoyer 211)

Some laws do indeed seem to hold across possible worlds, or at least across possible worlds that are near to the actual one. Take for example Newton's first law of motion: roughly, an object at rest stays at rest and an object in motion stays in motion unless acted upon by an external unbalanced force. This law seems to hold necessarily in the actual world, but it also seems to hold across possible worlds. Whether it holds in *all* worlds to which we have access is a claim difficult to defend; but it at least seems

to hold in the actual world and in worlds very near to it.

III. Ideal Necessity

Some thought experiments use idealization in order to discover certain laws of nature. The law of equal heights is explained through a celebrated thought experiment and is attributed to Galileo. It roughly asserts the following: Suppose that a perfectly smooth and round ball is rolled along a double inclined plane that is in the shape of a "U." In the actual world, factors such as air resistance, friction, and the absence of perfectly round balls will keep the ball from reaching the same height every time it rolls back and forth. However, if we idealize away these factors, then it seems that the ball should reach the same height every time. Furthermore, if one side of the plane were gradually lengthened, then the ball must travel farther and farther to reach its initial height. If the length of that side of the plane were lengthened forever, and because the ball must travel until it reaches its original height, then the ball must roll forever in a straight line (Cf., Sorensen).

Galileo's thought experiment set the stage for the formulation of Newton's first law of motion, which also idealizes away factors like air resistance and friction. Newton's first law holds in the actual world, but it also holds in worlds where the antecedent of the counterfactual conditional holds, namely, where there are objects not acted upon by any external unbalanced forces. In these other worlds, then, these objects free of the influence of external unbalanced forces will either remain in a state of rest or remain in a state of uniform motion.

The law also holds in possible worlds close to those where the antecedent holds, including in the actual world, but could very well not hold in far away possible worlds. We can ask, Can we conceive of a possible world where Newton's first law does not hold? If we can, then surely the law in question cannot be metaphysically necessary. But what would it be like for there to be a possible world where objects, free of external unbalanced forces, do not remain in a state of either rest or motion? It would mean that an object gratuitously changed from one state to another without sufficient reason; therefore, it would mean a violation of the Principle of Sufficient Reason—the claim that "everything must have a reason or cause" (Melamed n.p.). It is difficult to conceive of this principle not holding; however, if there were a possible world where the principle did not hold—and even this possibility might be illusory—then surely it must be a far away one. My claim is only that this law in question is more than physically necessary, yet not inevitably metaphysically necessary: not only does Newton's first law hold in the actual world, but *must* also hold in those worlds (and nearby ones) where the antecedent holds. In other words, it is *ideally necessary.*

Another example of a natural law discovered through idealization, and that is ideally necessary, is Newton's Law of Universal Gravitation (LUG). It, more or less, states that the force between any two objects is directly proportional to the product of the masses of the two objects and inversely proportional to the square of the distance between the two objects. LUG must have been discovered through idealization because of the falsity, in our world, of the antecedent—a two-element system.[2]

Because of the apparent conceiving of a possible world where LUG has the prop-

erty *having the force between two objects that is directly proportional to the product of the masses of the two objects and inversely proportional to the 11th power*—and not to the square, as in the actual world—*of the distance of the two objects,* then it follows that this law too could very well turn out to be metaphysically contingent. This possible world, however, must be a far away one because Kepler's first law, for example, depends on LUG's veracity. It follows that the latter's not holding would change the world in such a way that it renders it a far away one. And the law must hold in those worlds where the antecedent holds, i.e., where there is a two-element system, and possible worlds nearby. The law is ideally necessary, at least.

Swoyer complains that physical necessity does not explain the concept of a law of nature and that "the only characterization of physically possible worlds seems to be that they are those that have the same laws as the actual world" (Swoyer 211). This objection might also be directed toward *ideal necessity*: this notion is inadequate because, at best, *ideal* possible worlds are those that have the same laws as the actual world.

However, the claim is a false one. A characterization of ideal possible worlds in terms of the laws that actually hold would not be an adequate one. For all we know, there might also turn out to be physically necessary laws such that these do not hold in ideal possible worlds. The only claim I am making is that those laws that are discovered through an idealization methodology hold in those possible worlds (and nearby ones) where the antecedent holds. Ideal possible worlds, therefore, might lack some laws that hold in the actual world.

IV. Conclusion

In this paper, I have argued in favor of the *ideal necessity* of certain laws of nature: those laws that are discovered through an idealization methodology hold in those worlds (and nearby ones) where the antecedent of the law holds. Idealization involves a deliberate distortion of something—in this paper, I have postulated it as a counterfactual conditional—and is sometimes used in thought experiments, such as Galileo's rolling ball. At other times it need not be in the form of a thought experiment, such as in Newton's first law or the Law of Universal Gravitation.

Furthermore, ideally necessary laws of nature are not quite physically necessary because they hold in other possible worlds. Yet, they are not metaphysically necessary because there are some far away possible worlds where they do not hold. Whether there are also physically or metaphysically necessary laws of nature is an independent question.

Notes

1. I will use *idealization* in much the same fashion as Sorensen does, where the concept involves a deliberate distortion—something like a counterfactual conditional with a false antecedent.

2. Although, Such, for example, claims that "[t]he [idealizing] assumption, however, turns out to be superfluous for correct formulation (and hence, for proper reconstruction) of the law [LUG], at least within classical physics. This is due to the fact that in Newton's theory of

gravitation it is assumed that the force of gravitation interaction between some given (e.g. two) objects is independent of other influence—both gravitational and of a different nature—exerted upon those objects by the other objects" (125).

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