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Regularity attacked / Necessitarianism defended

This chapter, and Chapters 6 through 11, will be devoted to an examination of *universal* physical laws. *Statistical* laws will be examined in Chapter 12.

MOLNAR'S ARGUMENT

Molnar, taking his inspiration from Kneale, has devised an ingenious argument that is supposed to discredit the Regularity Theory of Physical Laws (Molnar 1969). Molnar's preferred alternative theory abandons the Regularists' view that physical laws are simply true, universal material generalizations. Like all Necessitarians, he denies that physical laws can be *merely* true; he argues that their truth must be strengthened by a modality. Kneale had called this modality "natural necessity." I will call it "nomological necessity."

The pivotal concept in Molnar's paper is not that of nomological necessity, but of physical possibility, which he sometimes imperspicuously refers to as "empirical possibility." More often, however, he simply writes "possibility," foregoing any qualifying term. I will be more careful. In quoting his definitions and the conclusion figuring in his proof, I will explicitly add the qualifier "physical" where it is clearly presupposed.

Molnar' s argument proceeds to draw from three definitions that are the core of the Regularists' theory, a conclusion that allegedly should be unacceptable to anyone who has reflected on the matter of physical laws and kindred subjects. The three definitions (here slightly revised) from which he proceeds are:

(D_1) *p* is a statement of a physical law if and only if:
- (i) *p* is universally quantified; and
- (ii) *p* is omnitemporally and omnispatially true; and

(iii) *p* is contingent; and
(iv) *p* contains only nonlocal empirical predicates, apart from logical connectives and quantifiers[1]

(D_2): If *p* states that a thing exists (or that a state of affairs obtains, or that an event occurs) then what *p* states is physically possible if and only if *p* is consistent with the conjunction of every physical law.[2]

(D_3): What *p* states is an unrealized physical possibility if and only if:
(i) *p* is a statement of physical possibility; and
(ii) *p* is false[3]

From these three definitions, he draws his conclusion, *C*. In *C*, he talks about "empirical propositions," but inasmuch as his points are purely logical and ontological, and not at all epistemological, it is – I think – quite safe to assume that he meant, rather, "contingent propositions." Indeed, in his very next sentence, Molnar himself casually switches to talk of "contingent existential propositions." Making, then, the obvious and required repair, *C* emerges in this way:

(*C*) For any *x*, if *x* is an unrestricted contingent existential proposition, then *x* is not a statement of unrealized physical possibility[4]

Now let us attend carefully to what Molnar goes on to say about *C*.

> The conclusion of the argument ... pits the Regularity Theory of Physical Laws and the definition of a statement of unrealized possibility against each other. It shows that if the Theory and the definition are both accepted there will be a set of statements – namely, the set of contingent unrestricted existential statements, no member of which may be used to express a judgment of unrealized possibility. This conclusion is intuitively unpalatable. 'There exists (somewhere, somewhen) a river of Coca-Cola' is surely not a judgment of

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1 Molnar 1969, p. 79. See footnote 1 in Chapter 4. In this quotation, Molnar's original "law of nature" has been changed to read "physical law." Hereinafter, changes to quoted material will be designated by a solidus, i.e. by a "/ ".

2 Molnar 1969, p. 80. Altogether, three changes have been made to D_2: physical law / law of nature; physically possible / possible; the conjunction of every / every. This last change was made for clarification, since a proposition may be consistent with every (i.e., each) member of a set of propositions without being consistent with them all taken together.

3 Molnar 1969, p. 80. Changed: physical possibility / possibility.

4 Molnar 1969, p. 81. Changes: physical possibility / possibility; contingent / empirical. A noncontingent existential proposition would, presumably, be something of this sort: There is a unique number that is twice the number 14.

> which we would want to be forced to say that either it is physically impossible or it is actually true. We all believe that this statement is both false and possible, as are many others like it.[5]

When Molnar writes of the example – that there exists somewhere, somewhen a river of Coca-Cola – that his intuitions tell him "that this statement is both false and possible, as are many others like it," I take him to be saying that even if it never, ever happens that there is a river of Coca-Cola, there 'really could be.' And by 'really could be' is meant not just that this proposition is logically contingent (and hence logically possible), but something stronger. For example, the proposition that pigs fly is logically contingent, and hence logically possible. But this sense of bare logical possibility, I presume, is not at all what Molnar has in mind when he argues that it is possible that there is a river of Coca-Cola. I take him to mean that not only is the problematic proposition logically possible (a judgment with which the Regularist will certainly concur), it is in addition *more* than 'just' logically possible. It enjoys as well a 'stronger' kind of possibility: physical possibility. Such a proposition is not just true in some possible world or other; it is true in some possible world very like this one in certain important respects.

So striking is the dilemma that Molnar believes to reside in the Regularity Theory that it is worth reconstructing meticulously so as to highlight its origin and thrust.

> Suppose we consider any unrestricted existential statement (e.g., "There is somewhere, somewhen, a river of Coca-Cola"). If this statement is true, there is no problem: It is – of course – physically possible. (Truth is a sufficient condition of physical possibility.) But suppose it is not true. Then the falsity of this existential statement logically implies a true universal statement ("Nothing is at any time or place a river of Coca-Cola"). But if, on the Regularists' account, this latter true universal statement is to be accorded the status of being a physical law, then the original (false) existential statement is not merely false, it is physically impossible, since it is logically inconsistent with its own negation, which is a physical law. In short, unrestricted timeless existential statements are either actually true or physically impossible. For this class of statements there is no third category of being false, but physically possible.

To avoid being impaled on the horns of this dilemma, Molnar considers various alternatives to the premises, trying, that is, to retract the horns. He focuses his attention on the premise that

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[5] Molnar 1969, p. 81.. Changes: Physical Laws / Laws of Nature; physically / empirically.

would have it that being true, universal, omnitemporal, omnispatial, contingent, and free of 'local' predicates constitutes a set of *sufficient* conditions for being a physical law.[6] He then examines four further conditions that at one time or another have been proposed as addenda to this set: (1) a requirement that the predicates be nonempty; (2) an epistemic requirement; (3) a requirement that laws be nondeducible from other laws; and (4) a requirement that physical laws be – in his words – "necessarily true." He eventually settles on the fourth condition.

It is strange that Molnar, who takes himself to be reconstructing and advancing Kneale's arguments, fails to observe Kneale's distinction between logical necessity (truth in "all possible worlds"; 1961, pp. 99-102) and what Kneale calls 'natural' necessity (truth in "all possible worlds *of some kind";* 1961, p. 102; emphasis added). Clearly, when Molnar advances what he calls "a necessitarian analysis" and speaks of physical laws as being "noncontingent," he must be understood to be promoting the view that physical laws are *nomologically* (naturally) necessary. It would hardly be creditable to attribute to him the view that physical laws are true in all possible worlds. Surely in *some* possible world, even if not in this world, the physical law that no objects with mass travel in excess of 299,792 km/sec. is false.

The reply to Molnar's, and by extension to Kneale's, argument can proceed on two different levels. On one level, we may focus on Kneale's notion of nomological necessity as truth in all possible worlds *of some kind.* No one seriously can doubt the heuristic value and fecundity of defining various species of necessity by means of restricting the set of all possible worlds. The problem lies not with the idea of the program, but with the prospects for its realization. How, exactly, in a noncircular way might Kneale's qualification be specified? Exactly which one of the infinity of proper subsets of the set of all possible worlds is the relevant one for these purposes? One might be inclined to answer, "those possible worlds only that have the same physical laws as the actual world." But, of course, this answer – although true – is useless. Since Necessitarians want to define physical laws as "those propositions alone that have nomological,

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[6] Containing "only nonlocal empirical predicates" – it would appear – is Molnar's concise way of saying that physical laws should make no reference to any specific objects, places, tunes, persons, etc.; i.e., they should be perfectly general throughout.

necessity," they can hardly, informatively define "being nomologically necessary" as "being true in all those possible worlds that have the same physical laws as the actual world."[7]

To date, no one has ever offered a way of restricting the set of all possible worlds so as to construct the 'right' set, without at the same time invoking the very concept the restriction is supposed to explicate, namely, nomological necessity.

If the prospects for a noncircular analysis seem both wanting and unlikely, there is still the opportunity to argue that physical necessity is a *primitive* notion, one that can be illustrated by examples but not further analyzed. Here the Necessitarian might appeal to his intuitions, or even to some special intellectual faculty, arguing that the difference can be 'seen,' 'felt,' or 'recognized,' even though not analyzed, in the two examples:

P1 *No mass travels faster than the speed of light*

and

P2 *There is no river of Coca-Cola*

Both these examples, he would allege, may be regarded – ex hypothesi – as: true, (logically) contingent, universally quantified,[8] omnitemporal, etc.; but only the former, and definitely not the latter, is nomologically necessary.

Regularists fail to catch the difference. Moreover, we fail, too, to see the usefulness of postulating such a difference. And we fail, too, to understand how the day-to-day practice of science – which *does* occasionally sort physical laws from nonlaws – could ever be sensitive to the alleged distinction between *P1* and *P2*.

The second level of reply is the more telling, however, because it is more circumscribed and less ambitious. Rather than challenging the prospects of the Necessitarian's carrying through his analysis of nomological necessity, this level of reply focuses on the specifics of the one argument at hand.

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[7] Popper, in his *Logic of Scientific Discovery* (1959a, p. 433), had tried to demarcate the relevant set of possible worlds in this way: ... all worlds that differ from our world, if at all, only with respect to initial conditions." Two pages later, Popper frankly admits that this definition is implicitly circular. Still other faults with his definition are reported by Nerlich and Suchting in "Popper on Law and Natural Necessity" (1967).

[8] Negative existential statements (such as *P2*), remember, expressed in prenex normal form become universal negative statements. (See Copi 1973, pp. 263-5.)

In pursuing this latter course of escaping the horns of Molnar's dilemma, we do so, not by retracting the horns, but by denying that the horns even exist. Our reply to be made to Molnar is that there is no real dilemma; that there is only the appearance of one; and that the "intuitively unpalatable" conclusion that it is physically impossible that there is a river of Coca-Cola, is not unpalatable. If the conclusion is unintuitive, then intuitions about this example need reforming.

Molnar's argument must be seen in proper perspective. Indeed, he offers a cautionary note himself: "Kneale's argument does not disbar those who accept these definitions from making ... [some true] ... statements of unrealized possibility."[9] Although I think his ensuing illustrative example is ill-chosen, his general point is perfectly correct. For the simple fact of the matter is that for many – if not the greater number of – kinds of propositions, Regularists and Necessitarians are in perfect accord as to whether these propositions are to be classed as physically possible or physically impossible. We both agree, for example, that the *singular* false proposition

P3 *Swartz owns two Rolls-Royces*

is physically possible, and the *singular* false proposition

P4 *Swartz travels in a rocket faster than the speed of light*

is physically impossible. Clearly, on both theories there will be propositions (e.g., *P3*) that are both false and physically possible. Molnar's complaint about the Regularity Theory is not that in it the category of being false and physically possible is empty; it is rather that this category has fewer members than his theory would allow. The dispute concerns *which* false propositions 'ought' to be physically possible; the dispute is not whether there are any such propositions. Both sides affirm that there are.

Of course, our respective reasons for saying that it is physically possible that Swartz owns two Rolls-Royces differ. The Necessitarian will want to say that this false proposition is physically possible because it is not logically inconsistent with any nomological truths. The

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[9] Molnar 1969, p. 81. This quotation is slightly modified as indicated for the sake of clarity.

Regularist, on the other hand, will want to argue that this proposition is physically possible because its existential generalization, namely,

P5 Someone *owns two Rolls-Royces*

is true, and hence the universal generalization, namely,

P6 No one *owns two Rolls-Royces*

is false and is thereby not a physical law. In other words, according to our theory, the proposition *P3,* that I own two Rolls-Royces, would turn out to be physically impossible if it were timelessly true that no one owns two Rolls-Royces; but this latter universal material generalization is false. Thus, although the routes to our respective conclusions about this example are through two different, incompatible theories, the conclusions themselves – for this example – coincide.

The contentious examples occur in one very special class only, namely, among false, contingent, unrestricted *existential* propositions (and derivatively with their singular instantiations). But even of these, only *some* are contentious, for example, the case in point, that there is somewhere, somewhen a river of Coca-Cola. Others are no trouble whatever, for example, that there is somewhere, somewhen an orthorhombic crystal of sodium chloride. The Necessitarian's intuitions tell him that of these two timelessly false, unrestricted existential propositions, one – the former – is physically possible, whereas the other is not. (The Regularist would deem them both on an equal footing as regards physical possibility; that is, they are both physically impossible.)

The crucial point of difference between the two theories does not, however, depend on examples. The Necessitarian's point is general, namely, that there should be *some* false, contingent, unrestricted existential propositions – never mind which ones – that are physically possible. The Necessitarian balks at our claim that this highly specialized class of propositions is empty. His intuitions are that there should be some propositions in this set, even if it is disputable which ones, exactly, they might be.

Intuitions about the properties of existential statements are risky on two counts. First, we are talking about *general* statements, and are thus at one step further removed from empirical data (broadly speaking, experience), which on most – if not all – epistemological theories is directly of singular statements. That is, knowledge of the truth-values of existential propositions is inferential, not direct, knowledge. Then, too, one might argue that knowledge of physical

possibility, and the informing of our intuitions about physical possibility, arise from ordinary cases of occurrence and nonoccurrence, and that one ought not to feel much confidence about attributing physically possible existence to a state of affairs that has never occurred.

Indeed, we are now at the crux of the matter. For the Necessitarian is arguing for the physically possible existence of something that not just has never existed, but that ex hypothesi does not now, nor ever will, exist. In effect, his is a claim that certain false kind-statements should be physically possible. For unrestricted existential statements are nothing other than statements that certain *kinds* of events (or constellations of properties) are instantiated. In allowing that certain timelessly false, unrestricted existential statements should be physically possible, the Necessitarian is arguing that certain kind-statements that are never, ever true should – nonetheless – be physically possible (e.g., that there is somewhere, somewhen a river of Coca-Cola). But here Regularists protest: The Regularity Theory does not deny that these events or clusters of properties could occur; when we say that it is physically impossible that they do, we mean only that – as a matter of fact – they do not occur. It is only by reading something stronger into "physical impossibility"[10] that Molnar's argument can be made to appear to threaten the Regularity Theory of Physical Laws. Molnar's intuitions, which have served him well as regards many ordinary, singular examples, cannot confidently be extrapolated to unrestricted, false existential propositions. Although we allow that some false propositions are, incontrovertibly, physically possible, for example, *P3*, we jib at allowing that false, unrestricted existential ones are. For to extend the category of physical possibility to any of this latter class of propositions will, just as Molnar suggests, require considerable emendation to the sufficient conditions for physical lawfulness. And in the clash of intuitions with theory, intuitions do not automatically have dominance. Intuitions sometimes must give way when the overall theory that results is simpler, more fruitful, and less problematic than the original preanalytic, intuitive theory. That unrestricted, false existential propositions turn out – contrary to initial expectations – in a certain theory to be physically impossible, does not by itself refute that theory. Rejection or acceptance must rest on the judicious weighing of the totality of the theory's implications.

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[10] Recall the commonly shared definition stated in Chapter 4.

I am inclined at this point to defend the Regularist's concept of physical impossibility by constructing an analogy in which I treat the
two terms "physically" and "impossible" to separate analyses. "Impossible" in "physically impossible," I want to say, functions like "impossible" in the sentence

S3 *"If no one ever makes a disc recording of Balbastre's* Piano Quartet, *then it is impossible that Maurizio Pollini does"*

Here the qualification "impossible" does not signify that the proposition expressed by the consequent clause is 'impossible'; it signifies only a relative modality, that this proposition is inconsistent with some other proposition.

Relative modalities in consequent clauses can be modified. For example, sometimes we modify the modal term with "physically," (other times with "morally," "legally," "theologically," etc.) When a relative modality in a consequent clause is modified, the modifier usually serves to identify the special status of the 'other' proposition, that is, the one in the antecedent. Should the modifier be "physically," then we have indicated that the 'other' proposition is a physical law, for example,

S4 *"Since no mass travels faster than the speed of light, it is physically impossible that a Saturn rocket does"*

There is no need to think that the term "physically" connotes any special, intrinsic, mysterious quality of the consequent proposition. Compare: One might introduce the relative modality "gramophonologically impossible" in the above example, *S3*, and thereby signify that the antecedent clause is of a certain kind, namely, being a general proposition about the history of the recording industry. We might then want to say that, on the supposition that no one ever makes a disc recording of Balbastre's *Piano Quartet*, it is gramophonologically impossible that Pollini does. The qualified modality here indicates the logical rivals of the latter proposition. It should not make us want to worry about timelessly unrealized gramophonological possibilities, nor should we want to postulate 'Edisonian necessities' (the analogs of nomological necessities) to accommodate them. We should not feel moved to go along with an Historico-Necessitarian who says that only some – certainly not all – gramophonological impossibilities are 'real' gramophonological impossibilities, that is, the real ones are those only that are logically inconsistent with Edisonian necessities.

Where this analogy ultimately fails, and the reason why it does not serve as an irresistible incentive to discard Necessitarianism, lies in the facts that "physical impossibility" – unlike "gramophonological impossibility" – is thoroughly entrenched in our language and that the corresponding concept has taken on 'a life of its own.' And thus the Necessitarian can rejoin that the analogy does not go through; that there is something *more* to the concept of physical impossibility than this analogy would attribute to the corresponding concept of gramophonological impossibility.

But even if the analogy cannot refute Necessitarianism, it can highlight the precise area of dispute between the two camps and also suggest how each might formulate its own analysis of the concept of physical possibility. In particular, it shows how Regularists can, in terms of their own theory, deflect Molnar's criticism. The dispute, it should be clear, is *between* two competing theories. Regularists can, with perfect consistency, deny that Molnar has uncovered a problem *within* their theory.

Perhaps, now, it is time to turn from an analogy to a summing up. A table of pertinent differences elicited to this point has been cataloged in Table 1 (page 60).

By far the most striking difference between these accounts of physical laws occurs in line iii. On the Regularists' account, a certain contingent proposition, if false, is inconsistent with the set of physical laws, whereas, on the Necessitarians' account, that proposition, whether true *or* false, is consistent with the set of physical laws.

What this difference comes down to is that, on the Regularists' account, the contents of the set of physical laws are highly 'sensitive' to the truth-values of (certain) existential propositions; on the Necessitarians' account, the contents of the set of physical laws are much less 'sensitive' to the truth-values of (certain) existential propositions. Which of these accounts is ultimately to be preferred remains to be judged.

SINGULAR PROPOSITIONS AND PHYSICAL POSSIBILITY

Attributing physical possibility to *singular* propositions is somewhat more problematic than attributing physical possibility to particular (or existential) propositions. Consider a slight variant of the singular proposition *P4* cited earlier in this chapter. Consider, instead, the proposition that Swartz (himself) travels faster than the speed of light. We want to say that this singular proposition is physically impossible. But note:

Table 1. *Necessitarian and Regularity theories applied to three test propositions*

Necessitarian theory	Regularity theory
	I. There is a river of Coca-Cola
i. Is logically contingent (i.e. could be true and could be false).	i. Is logically contingent (i.e. could be true and could be false).
ii. Is – presumably – physically possible, whether true or false.	ii. Is physically possible, if true; is physically impossible, if false.
iii. Is – presumably – whether true or false, consistent with all physical laws.	iii. Is, if false, inconsistent with at least one physical law.
	II. Nothing is a river of Coca-Cola
iv. Is logically contingent.	iv. Is logically contingent.
v. Satisfies all conditions of D_1 (i.e., is true, universal, omnitemporal, omnispatial, etc.).	v. Satisfies all conditions of D_1 (i.e., is true, universal, omnitemporal, omnispatial, etc.).
vi. Is – presumably – not nomologically necessary.	vi. Is *not* nomologically necessary. (*No* proposition whatsoever is nomologically necessary.)
vii. Is *not* a physical law (because of vi above).	vii. *Is* a physical law (because of v above.)
	III. No mass is propelled beyond the speed of light
viii. Is logically contingent.	viii. Is logically contingent.
ix. Satisfies all conditions of D_1.	ix. Satisfies all conditions of D_1.
x. Is nomologically necessary.	x. Is *not* nomologically necessary. (*No* proposition whatsoever is nomologically necessary.)
xi. *Is* a physical law (because of ix *and* x above).	xi. *Is* a physical law (because of ix, alone, above.)

It is, only if we assume something more than is in fact claimed in the proposition itself; that is, the physical impossibility follows only from this singular proposition taken in conjunction with another, namely, that Swartz is (/has) a material body. Without this understanding, the claim is not incompatible with the physical law concerning the maximum attainable velocity. For that law is not unconditionally general, but only conditionally so: It applies only to

bodies having mass. “Things”across the surface of an object that is at an angle to the expanding wavefront of the light can achieve any velocity up to and including an infinite velocity. To argue, then, that it is physically impossible that Swartz should achieve a velocity in excess of that of light requires a tacit assumption beyond that stated in the proposition that I do; we must tacitly assume that I have a material body.

It is easy to overlook the categorizations we make of things when we invoke their names or denominate them with gestures, demonstratives, etc. Now, although I am certainly not advancing a theory of naming, I do want to suggest that singular propositions whose physical possibility is in question must be construed within a context of categorizing their subjects before the question can have any determinate answer. Is it possible that Julie should lay an egg? Well, it all depends. Who is Julie? Is Julie male or female? Is Julie a primate or a fowl? Is Julie living or deceased? Is Julie a living thing or an inanimate object? Does Julie have functioning ovaries? Etc., etc.

The point can perhaps better be made by switching to the material mode from the formal. The claim can then be put this way: Whether a situation, a sequence of events, or a constellation of properties, etc., is physically possible or not, depends critically – as was insisted in Chapter 2 – on what description one gives. As descriptions become more robust, the probability decreases of the situation that is being described being physically possible. Suppose there is no lamp on this desk. Is it physically possible that there should be? The answer is “yes,” if by “this desk” we intend nothing more than “a desk”; but if we intend something more specific, if we understand by “this desk” not just “a desk” but (as this desk in fact is) one made of balsa wood with two of its three legs cracked clear through and held temporarily only with a twist of cellophane tape, the preferred answer may well be “no.”

Existential statements often are more specific as to categorizations than are singular statements. Contrast “Is it physically possible that Julie should lay an egg?,” with “Is it physically possible that a primate should lay an egg?” That existential statements often have categorizations of their subjects “built-in,” as it were[11] should not, however, blind us to the need to *provide* those categorizations in the case of singular propositions whose physical possibility is at issue.

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[11] Often, but not always; e.g., “It is physically possible that *something* (unspecified as to kind) should exceed the speed of light.”