"Laws of Nature" as an Indexical Term: A Reinterpretation of Lewis's Best-System Analysis

Abstract:

David Lewis's best-system analysis of laws of nature is perhaps the best known sophisticated regularity theory of laws. Its streng+ths are widely recognized, even by some of its ablest critics. Yet it suffers from what appears to be a glaring weakness: It seems to grant an arbitrary privilege to the standards of our own scientific culture. I argue that by reformulating, or reinterpreting, Lewis's exposition of the best-system analysis, we arrive at a view that is free of this weakness. The resulting theory of laws has the surprising consequence that the term "law of nature" is indexical.

1. The Best-System Analysis

The best-system analysis (henceforth, the BSA), as presented in Lewis (1994), runs as follows. The laws of nature are those generalizations that belong to the best deductively closed system of propositions all of whose members are true. These systems are required to specify only the spatiotemporal arrangement of local, occurrent properties; no mention of causal relations, counterfactual or dispositional features, or modal facts are allowed. The "best" system is the one that achieves the best balance between strength, i.e. information content, and simplicity. Strength, simplicity and the balance between the two have to be measured according to some set of standards, and there are many possible standards; the BSA requires that the standards be ours, or rather those employed by our scientists in their task of theory selection. Moreover, these standards are to be picked out rigidly: in any possible world, the best system is to be picked out using the standards we use in the actual world, rather than the standards used by our counterparts in that world. (The original presentation of the BSA, in Lewis (1973), allows for a tie among several best systems; more recently, Lewis has strengthened the account to require a single best system; if there is no unique best system, then according to Lewis, nothing clearly deserves the title of "laws of nature.")

2. The Problem with Lewis's Reference to Our Standards

Its reference to our present standards of strength, simplicity and balance seems to be a liability for the BSA. It seems that if there are any such things as laws of nature, then they must exist independently of us and our

practices, so a reference to our standards seems at first blush to be completely out of place. We need to be careful about how we formulate this objection to the BSA, however; some obvious ways of doing so fall flat. For example, it is tempting at first to say that the BSA makes the laws of nature arbitrary, or that it implies that if our standards had been different, then so would have the laws. Neither of these accusations is correct, however, simply because the BSA requires that the standards at issue be picked out rigidly (see Lewis 1980, 123).

A more serious objection to the BSA, however, is that its reference to our standards makes it arbitrary. There are many possible sets of standards of strength, simplicity and balance. Most of these sets of standards, no doubt, are pretty uninteresting. But there seems to be no reason to think that the ones we happen to use now are the only ones worthy of note, or the only ones that rational beings could use. It seems possible that the Martians, who have a very highly developed science, use standards very different from ours, and that these standards would pick out a different best system from among those true in our universe than our standards would. It could also be the case that the scientists of the seventeenth century, and those of the twenty-seventh, use standards that would pick out a different best system. Why should we think that our standards are the special ones that play such a crucial role in the analysis of the concept of a law of nature? If the Martians set out to analyze their concept of a law of nature, and they were guided by the same reasoning that guides Lewis in his defense of the BSA, then it seems obvious that they would arrive at an analysis that is just like the BSA, except that their own standards would be rigidly referred to in place of ours. But if their standards are sufficiently different from ours that they pick out a different best system, then their account will be inconsistent with Lewis's. Who is to say whose analysis would be correct? Isn't it arbitrary (and, to use John Carroll's term (Carroll (1990, 201-2)), *chauvinistic*) of Lewis to suppose that the version of the BSA that refers rigidly to our standards, rather than those of the Martians, contains the truth about what laws of nature are?

Lewis (1994, 479) replies to this objection by suggesting that if nature is kind, then there will be a unique, "robustly best" system that will turn out to be best on any reasonable set of standards. He suggests further that our thinking about laws presupposes this hope. If the hope is unrealized, then, according to

Lewis, there may just be no fact of the matter about what the laws of nature are. Lewis thinks this is a possibility we can safely ignore (for the time being at least). Surely, though, we should analyze the concept of a law of nature without banking on such a hope if it is possible. In this paper, I want to argue that this is possible to do, without abandoning Lewis's approach.

3. A Solution: The Indexical BSA

The reference to our own standards invites skepticism about the BSA, but it is there for a very good reason. In developing the BSA, Lewis takes as one of his main desiderata that the analysis should explain why laws tend to support counterfactuals. Lewis's analysis of laws of nature takes for granted a notion of the similarity relation among possible worlds. This relation is taken to be fixed by the context; in particular, one possible world resembles another to the extent that they agree on a large number of what the speaker and audience take to be their most important features. For this reason, the features of the actual world that we take to be the most important are the ones we tend to hold constant for the purposes of counterfactual discourse. In science (especially in fundamental physics), we tend to think that the most general, deep and pervasive regularities in the world are among its most important features. To call a regularity deep and pervasive, though, is rather vague, and in any event what counts as a deep and pervasive regularity, rather than a trivial or incidental regularity, seems to depend on the standards of the person making the assessment. Lewis's suggestion is that whatever is, by our lights, the best system, i.e. the one that strikes the best balance between informativeness and simplicity, is by our lights the class of deep and pervasive regularities *par excellence*. If this idea is basically right, then the BSA appears to do an admirable job of explaining why the laws of nature are among the things we tend to hold constant in evaluating counterfactuals. For, if the BSA is right, the laws just are those regularities that, by our lights, count as the most deep and pervasive regularities in the world. This is a nice feature of the BSA; unfortunately, this is just what invites the charge of arbitrariness. By referring to our standards in the analysis of laws, the BSA buys the ability to give a nice account of why we treat laws as counterfactually robust, but the great price of this pearl is that the BSA is left open to the charge of arbitrarily

supposing that the nature of the laws of nature has a built-in preference for the standards we happen to use. It would be a welcome turn if we could find a way to keep this advantage of the BSA while shedding the arbitrary privilege granted to our own standards.

Toward this end, I want to introduce some definitions. First, let's define a function, BSA(-), that maps sets of standards of strength, simplicity and balance onto intensions, that is, onto functions from possible worlds to sets. For a set of standard S, and a possible world w, let BSA(S)(w) be the generalizations belonging to the deductively closed system all of whose members are true in w, which achieves the best balance of strength and simplicity as measured by the standards S. If S_{us} designates our own standards, then Lewis's claim is that our term "laws of nature" has an intension given by BSA(S_{us}). Now let's introduce two artificial predicates, defined as follows:

> "P is an r-law" is true at world w iff P is a member of the value of the function BSA(S_{us}) at w.
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> Any given token of "P is an i-law" is true at world w iff P is a member of the value of the function BSA(T) at w, where T is the set of standards employed by the speaker who produces the token.

(Thus, "i-law" is a token-reflexive, or indexical term.) Now we can define two theses:

The rigidified BSA: The term "law of nature" functions semantically just as "r-laws" does.

The indexical BSA: The term "law of nature" functions semantically just as "i-laws" does.

Lewis appears to commit himself to the rigidified BSA; that seems to be the most natural way of interpreting his expositions of the BSA. So it might seem that the indexical BSA is an alternative to Lewis's theory of laws. However, it appears that everything Lewis actually says in these expositions is perfectly consistent with the indexical BSA. So it seems to me that it might be better to say that these two theses are two alternative interpretations of Lewis's theory of laws. At any rate, I want to argue here that the indexical BSA is preferable to the rigidified BSA, in that it evades the charge of arbitrariness leveled against Lewis while

preserving all of the advantages that he claims for his account of laws.

4. Advantages of the Indexical BSA

How does the indexical BSA evade the charge of arbitrariness? Consider again the Martians, who advocate their Martian version of the BSA. Lewis's view looks arbitrary, because it looks like he and his Martian counterpart can't both be right, and it looks like the only reason to prefer Lewis's view to the Martian's is an arbitrary preference for our own standards. But on the indexical BSA, Lewis and his Martian counterpart needn't contradict one another at all. When Lewis and the Martian have the following exchange:

> Lewis: "The laws of nature are the members of the best deductive system, as measured by our standards,"
> Martian counterpart: "The laws of nature are the members of the best system, as measured by Martian standards,"

they needn't be saying mutually inconsistent things at all, any more than they are when they have the following exchange:

> Lewis: "I am David Lewis,"
> Martian counterpart: "I am Zorg."

This is because the token of "laws of nature" produced by the Martian has a different extension from the homonymous token produced by Lewis. Since there is no dispute between Lewis and the Martian, Lewis has no need to settle this dispute, arbitrarily or otherwise.[1]

I claimed above that the indexical BSA enjoys the benefits claimed by Lewis for the BSA. The

[1]This seems to allay the worry that the BSA arbitrarily privileges the standards of our own culture over those of other cultures. But as Carroll (1990, 201-2) points out, there is also reason to worry that the BSA arbitrarily privileges our present standards over those of our culture's past and future scientists. This latter worry raises issues that are beyond the scope of this paper; they are dealt with in my (1998b).

principal advantages Lewis alleges for the BSA are four: (1) The BSA is consistent with Humean supervenience[2]; (2) the BSA gives a satisfying account of why we tend to hold laws constant in the evaluation of counterfactuals; (3) the BSA makes it plausible that laws of nature are among the things scientists endeavor to discover; (4) the BSA implies that the laws of nature are objective. The indexical BSA is clearly consistent with Humean supervenience: The extension of any token use of "laws of nature" is determined solely by the spatiotemporal distribution of local, occurrent properties -- for these determine what the competing systems are, and the standards of the speaker (which are picked out rigidly) determine which of these systems is best. It also seems that Lewis's argument that the BSA accounts for the counterfactual robustness of laws extends to the indexical BSA; in fact Lewis's argument may give more support to the indexical BSA than it does to the rigidified BSA. For, whenever we use the term "laws of nature," we will be referring to a class of propositions that, by our lights, are among the most important features of the actual world, and so one of the most important criteria of similarity to the actual world. Similarly, when Zorg the Martian evaluates counterfactuals, he will take it that the propositions he refers to as "laws of nature" are especially deserving of being held constant. These can be expected to be somewhat different from the propositions we tend to hold constant, but that is only to be expected: Since the Martians have such different standards of information content and simplicity from ours, it is natural to suppose that they will evaluate counterfactuals somewhat differently from us. (By contrast, it is a little hard to see how the rigidified BSA explains why the Martians should tend to hold laws constant in the evaluation of counterfactuals, for there seems to be no reason to suppose that the r-laws will be very important features of the actual world, according to their standards.) I won't go into much detail about the third advantage, but it seems clear that to the extent that the BSA makes it plausible that the laws are among the things scientists hope to discover, the indexical BSA will also make this plausible; moreover, the indexical BSA will make it plausible that the truths in the extension of the Martians' token uses of "laws of nature" will be among the principal targets of Martian science.

This leaves only the fourth advantage: the objectivity of laws. On the indexical BSA, every token

[2]This doesn't count as an advantage to all philosophers. Carroll (1994, chapter 3) presents an argument against Humean supervenience about laws. I think this argument fails, however, as I argue in my (1998a).

assertion of the form "P is a law of nature," or of the form, "P is not a law of nature," or of the form, "the laws of nature have feature F" (where F has an objectively defined extension), will have a truth condition that is objectively either satisfied or not, independently of what anyone thinks about the matter. It seems to me that this is all of the objectivity we should ask for from an account of laws.

5. Objectivity and the Relation between Laws and Counterfactuals

It may seem to some, however, that a stronger form of objectivity is required. An intuition that might motivate this complaint is admirably expressed by David Armstrong:

> Suppose it to be a law that Fs are Gs, suppose that *a* is not F, but it is not an unreasonable suggestion that *a* be F. We say that if *a* had been an F, it would have been a G. According to Lewis we do this because the system in which the Humean uniformity that Fs are Gs fits, the system of laws so-called, is important to us. We therefore keep it constant even while supposing what we know to be false, that *a* is F. Suppose, however, that we, or our culture, were quite uninterested in the system of laws. Then, presumably, it would fail to be the case that if *a* were an F, then *a* would be a G.
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> But it does not seem that the truth-conditions for counterfactuals can be as relative as that. We think that if *a* were an F, then *a* would *have* to be a G. Is this necessity only a necessity relative to standards of importance? (Armstrong 1983, 69-70.)

Armstrong's objection might be construed along the following lines. It is widely maintained that the relation between laws and counterfactuals can be partly expressed by the following principle, which I'll call *nomic preservation*, or NP:

NP: If P is false but physically possible, and the laws of nature entail that P$\Box\!\!\rightarrow$ Q, then P$\Box\!\!\rightarrow$ Q.

It seems to be widely held not only that NP is true, but that its truth is independent of the context. It is uncontroversial that the truth conditions of many counterfactuals are highly sensitive to the standards of importance that are relevant to the context in which they are asserted. The claim being considered, however, maintains that NP places a constraint on the truth values of counterfactuals that holds no matter what the

context. The complaint being lodged against the BSA is that it ties the counterfactual-supporting role of laws too closely to the standards of our culture. It is easy to see how this might make one suspicious of the rigidified BSA, but it doesn't work well as an objection to the indexical BSA. For on the indexical BSA, given Lewis's highly plausible claim that what one takes to be the best system will be what one takes to be the system of deep and pervasive general truths, it seems that any rational being, no matter what her standards of strength, simplicity and balance, will use the term "law of nature" to refer to a class of truths that she will tend to hold constant in evaluating counterfactuals in the way expressed by NP. For example, the Martians considered earlier will take NP to be true, and will tend to abide by it in their practices of evaluating counterfactuals, and we will do the same. Of course, the Martians will be using the term "laws of nature" to pick out a different class of truths from us, but nonetheless, their token assertions of NP will be true. So, even if NP is true, and even if it is true independently of context and standards, this does not yet constitute a persuasive argument against the indexical BSA.

Still, it is unlikely that someone sympathetic to Armstrong will be satisfied here. Armstrong's complaint is based on the intuition that the relation between laws and counterfactuals has nothing to do with anyone's standards. I've argued that even on the indexical BSA, NP will be true no matter what our standards are, but this is because the standards that govern counterfactual evaluation and the standards that are appealed to in the indexical BSA covary, so to speak, and not because the relation between laws and counterfactuals has nothing to do with standards.

Perhaps a better way of understanding Armstrong's complaint appeals to the principle NPR:

NPR: If P is false but physically possible, and the **Ls** entail that P$\Box\!\!\rightarrow$ Q, then P$\Rightarrow$ Q,

where "**Ls**" is a rigid designator that refers to the laws of nature -- in other words, "**Ls**" is a rigid designator that shares the reference of our term "laws of nature." The indexical BSA might be able to provide an account of why NPR should be thought to govern our own counterfactual reasoning, but it seems to be unable to

provide any reason to think that NPR will govern the Martians' counterfactual reasoning. This is because, if the indexical BSA is right, then what we refer to as the laws of nature -- the **Ls** -- turn out to be exactly the sort of thing that we ought to consider to be an important criterion of similarity to the actual world, but does not explain why they should be of any particular interest to the Martians as a criterion of similarity to the actual world. I think this way of putting Armstrong's complaint nicely captures the intuition underlying the quoted passage, and it does seem capable of causing trouble for the indexical BSA.

However, this complaint is only as strong as the case for the context-independent truth of NPR. Is there any reason to think that the truth conditions of all counterfactual conditionals, no matter what the context of assertion, are subject to NPR? One could simply stipulate that by "counterfactual conditional" one means a kind of conditional whose semantics are consistent with NPR, but that wouldn't be very interesting. What we want is a good reason to think that the class of assertions we call counterfactuals really do have this kind of semantics. It seems that whatever evidence we could adduce for this claim would have to consist of actual cases of our evaluating counterfactuals. But this kind of evidence seems to be neutral between the position that counterfactuals are governed by the principle NPR, and the position that they are governed by NP. The relevant linguistic phenomena seems to consist of cases in which we hold constant the propositions that we take to be laws of nature for the purposes of evaluating counterfactuals. Such phenomena appear to be predicted equally well by NP and by NPR. The situation here seems to be a standoff. It's hard to see whether we ought to think that laws are governed by NPR, or just by NP. If the former, then the indexical BSA seems to be in bad shape; but there doesn't seem to be any compelling evidence that the former case obtains.

Where does this leave us? Armstrong cites an intuition to the effect that the connection between laws and counterfactuals must be, in some sense, more objective than Lewis's account of laws can allow. I've tried in a couple of ways to make precise the sense of objectivity at issue. The first way involved insisting that the principle NP imposes a constraint on the truth conditions of counterfactuals that does not depend on the standards of the standards in play in the context of assertion. It appears that the indexical BSA is not in the least threatened by this idea. The second way involved insisting that the distinct principle NPR imposes a

context-independent constraint on counterfactuals. This would raise a serious problem for the indexical BSA; however, it is far from obvious why we should accept NPR. Perhaps there is some other sense that can be given to Armstrong's notion that the relation between laws and counterfactuals is objective, or independent of us and our standards, that would be damning to the indexical BSA. But the only way I can respond to this possibility is to challenge anyone sympathetic to Armstrong's complaint to specify this sense.

In conclusion, then, it appears that the BSA is significantly strengthened if we reformulate it, or reinterpret it, as the indexical BSA. This has the surprising consequence that "law of nature" is a token-reflexive term, but nevertheless the account has much to recommend it. The indexical BSA enjoys all of the principal advantages claimed for the BSA by its supporters, and is not susceptible to the charge of arbitrarily privileging the standards of our own scientific culture. It makes the laws objective in the sense that token assertions concerning the laws typically have objective, well-defined truth conditions. It implies that the claim that laws support counterfactuals in a distinctive way will be true for anyone, regardless of what standards they happen to use. There may yet be some brand of objectivity that ought to be attributed to laws that is denied them by the indexical BSA, but it is far from clear what brand of objectivity that would be. The moral here may be that, perhaps like "now" and "the present," the term "laws of nature" turns out to have a semantical role quite unlike what one might have expected before delving into philosophy.

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