

Laws and Criteria

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I Introduction

1. Laws: Regularities versus nomic necessitation — the problem

Debates concerning the analysis of the concept of law of nature must address the following problem. On the one hand, our grasp of laws of nature is via our knowledge of their instances. And this seems not only an epistemological truth but also a semantic one. The concept of a law of nature must be explicated in terms of the things that instantiate the law. It is not simply that a piece of metal that conducts electricity is evidence for a law that metals conduct electricity. It is also the case that to explicate what it is for there to be such a law requires, and requires little more than, alluding to the fact that the piece of metal conducting electricity is an *instance* of that law. This is the driving intuition behind regularity theories of laws — to understand the concept 'law,' as in 'it is a law that metals conduct electricity' one need only understand little more than what it is for something to be a metal and to conduct electricity and the concept of universal generalization. On this view a law just is a regularity (or some kind of regularity) among its instances.

At the same time, as I shall argue later, any identity between laws and regularities fails to leave room for metaphysically important relationships between laws and their instances, namely that laws explain their instances and that instances are inductive evidence for the existence of the corresponding laws. Explanation and induction require what I call an *ontological gap* between laws and regularities — they cannot be the same.

The regularity theories are first-order accounts of law — the highest order universal they need to employ is a first-order universal. Accounts

proposed by Armstrong, Dretske, and Tooley are second-order, since they appeal to irreducibly second-order relations among universals.¹ So binary laws, e.g. metals conduct electricity, are characterized as relations of nomic necessitation, N, among universals: N(being metallic, conducts electricity). But, as I shall also argue, while this respects the need for an ontological gap between laws and their instances (or the regularities made up of their instances), it makes the gap so wide that it is difficult for any semantic or epistemic bridge to span. The notion of nomic necessitation suffers from Hume's complaint that it is inexplicable in terms of its instances, and in so far as we can understand that notion, laws would be unknowable.

Both the regularity and the nomic necessitation approaches regard laws as metaphysically contingent. They both take the properties or universals mentioned or related in laws to be ontologically prior to laws, i.e. they regard these entities as essentially categorical rather than dispositional. The central aim of this paper is to outline a solution to the dilemma posed above, a solution that also operates within the same contingentist approach to laws and categoricallist approach to properties.

2. Laws: the solution

This solution I propose allows both for the existence of an ontological gap but also for its being bridged both conceptually, providing an explication of the concept of lawhood in terms of instances, and epistemologically, showing how instances can be evidence for the existence of laws. This solution employs the notion of a *criterion*.

Criteria are facts that provide *a priori* good evidence for a proposition. In the case of propositions asserting the existence of laws the idea is that it is part of the concept of law that facts that would be singular instances of the law count as evidence for the existence of the law. While many evidential relations are *a posteriori*, it is *a priori* that an emerald that is green is *prima facie* evidence for the law that there emeralds are green. Since the relation between the criterion and proposition is conceptual, the semantic requirement mentioned above is respected. At the same time criterial evidence, like non-criterial evidence, is defeasible. No amount of criterial evidence, even the existence of a perfect universal

1 D. Armstrong, *What is a Law of Nature?* (Cambridge: Cambridge University Press 1983) and *A World of States of Affairs* (Cambridge: Cambridge University Press 1997); F. Dretske, 'Laws of Nature,' *Philosophy of Science* 44 (1977) 248-68; M. Tooley, 'The Nature of Laws,' *Canadian Journal of Philosophy* 7 (1977) 667-98

regularity as seen from a God's-eye perspective, entails the existence of the law. Hence there is also the ontological gap.²

The structure of the paper is as follows. In §2 I shall present my solution in detail. In §§3-4 I shall compare it to the regularity theories and to the nomic necessitation view respectively. In §5 I shall consider an important objection before concluding in §6.

II Criteria and Laws

David Armstrong thinks that regularity views and nomic necessitation views of his (and Michael Tooley's) kind are the only alternatives; this is because he sees the explication of concepts in terms of providing *truth conditions*. Truth conditional analyses mean that ontology, epistemology, and semantics all line up together. The regularity theorist concentrates on the role of first-order facts as evidence and so gives a first-order semantics which leaves no ontological gap between the regularities and the laws. The nomic necessitarian rightly sees the need for an ontological gap and so for a second-order concept of law, but the truth conditional approach to semantics means that the evidence is left too far behind. What we need is to have an explication of second-order concepts in first-order terms that does not permit ontological reduction. This can only be done if that explication is not truth conditional. While the account has elements of both the necessitarian and the regularity accounts, its semantic approach differs from both. As Peter Lipton has helpfully described my view, 'Armstrong provides the metaphysical picture, Lewis the semantically privileged epistemology, and the truth conditions will not be missed.'³

1. Criteria and concepts

The realist about semantics has the following beliefs: the meaning of a sentence rests in its truth conditions; and the meaning of a subsentential

2 In what follows I shall use the terms *regularity* and *uniformity* to refer to general facts and the term *generalization* to refer to a statement or proposition asserting the existence of such facts. If a generalization is true, then there exists the corresponding regularity. Some (but not necessarily all) versions of semantic anti-realism that are consonant with the anti-realism and minimalism of this paper may wish to make this a biconditional.

3 P. Lipton, Review of Bird, *Philosophy of Science*, *British Journal of the Philosophy of Science* 50 (1999), 165

expression rests in the contribution it systematically makes to the truth conditions of sentences in which it may appear. The anti-realist about semantics wants to deny that this is the most general characterization of meaning. For the anti-realist the meaning of a sentence lies in the conditions which would justify asserting it — the meaning of an expression may be satisfactorily and fully explained by specifying the conditions which would justify its use. (In *some* cases such conditions are also truth conditions.)⁴

The particular instance I wish to employ is that of the explanation of meaning by supplying *criteria*. Certain concepts can be fully explained or introduced by supplying criteria for their application where what I mean by ‘criterion’ is explained by the following:

- (i) the relation between the criterion and what it is a criterion for is *evidential* (i.e. the relation is not a matter of being a logically necessary or sufficient condition, but is one which provides some degree of warrant for assertion);
- (ii) the fact referred to in (i), that the relation is evidential, is a logical fact. That is, it is part of the concept being explained that the criterion counts as good evidence for the concept’s being correctly applied. The relation is not an empirical relation.

Of the two characteristics of criteria, (ii) is what makes the relation between criterion and concept an explanation of meaning, and (i) is what gives this explanation its anti-realist flavor, because the explanation is not in terms of truth conditions but rather in terms of evidence and

4 Here I am discussing only realism and anti-realism about semantics, not about science. There are connections, but none of them are in play in this discussion. The concept of a criterion originates with Wittgenstein, but I make no claim that the concept as I use it is exactly his. G.P. Baker discusses Wittgenstein’s concept at length in ‘Criteria: A New Foundation for Semantics,’ *Ratio* 16 (1974) 156-89. I differ with Baker/Wittgenstein in that the latter take the fulfillment of a criterion to provide certainty (the absence of doubt). While criteria (as I understand them) can confer this, they do not have to — one might have a reasonable suspicion (but not knowledge) that defeating conditions are satisfied, in which case doubt might well be appropriate. Baker discusses an earlier incarnation of the criterion concept in Wittgenstein, which he calls the H-relation. The H-relation gives *a priori* probabilistic justification. This he rejects on the grounds that later Wittgenstein held that only *a posteriori* relations are probabilistic and that an H-relation will not provide certainty. Even if this is a correct understanding of Wittgenstein, that does not make the H-relation incoherent. My use of the criterion concept is perhaps closer to the H-relation than the C-relation (criterial relation) as Baker spells it out.

warranted assertion.⁵ The obtaining of a set of criteria justifies, necessarily, the application of the concept in question. But the necessity of the justification does not entail that what is thereby justified is certain. Like contingent evidence, criterial evidence may be defeated, for instance if further criterial conditions are not fulfilled, or if the criteria for the application of some incompatible concept are better fulfilled.

According to Christopher Peacocke, we can individuate a concept by its possession conditions, that is, what it is to grasp the concept.⁶ In particular, possessing a concept may be a matter of taking certain conditions to provide warrant for making an assertion. For criterial concepts, I suggest, the general form of such possession conditions for the criterial concept F will be (in what I will call a P-characterization):

The (criterial) concept F is that concept C to possess which it is necessary and sufficient that a thinker take it to be the case that:

$E_1a, E_2a, \dots E_na$ each provide a partial warrant for asserting Ca , and $H_1a, H_2a, \dots H_na$ each remove or reduce such a warrant.

This P-characterization of criterial concepts shows that the criterial relation is evidential, since it provides (defeasible) warrant, while recognizing that fact is constitutive of the possession of the concept. The general P-characterization for criterial concepts is an application of a slightly modified version of Peacocke's schema for explicating the content of concepts. The general idea is that to possess a concept will be to have a capacity to have appropriate propositional attitudes.⁷ Such capacities will be dispositions of which the thinker need not be consciously or reflectively aware. What facts she 'takes to warrant' what other facts

5 I take it without argument that if E is evidence for P then possessing E gives one some degree of warrant (other things being equal) for asserting P. E may not be enough to give one a full warrant for asserting P since the evidence may not be enough to allow one to know P. See T. Williamson, 'Knowing and Asserting,' *Philosophical Review* 105 (1996) 489-523. However, since possessing evidence for P brings one closer to knowing P, it therefore adds to one's justification for thinking P and being disposed to assert P.

6 C. Peacocke, *A Study of Concepts* (Cambridge, MA: The MIT Press 1992)

7 This stems from Peacocke's Principle of Dependence: 'There can be nothing more to the nature of a concept than is determined by a correct account of the capacity of a thinker who has mastered the concept to have propositional attitudes to contents containing that concept' (5). The P-characterization I give is modified in that I regard the conditions cited as giving necessary and sufficient conditions for concept possession. Without making the conditions sufficient, there is a danger that the characterization may not specify a unique concept.

will be shown in the inferences she is disposed to make, what beliefs she forms given certain information and so forth, and need *not* be manifested by assertions equivalent to 'I take p to provide me with warrant for asserting q .' In this respect and in others the *a priori* warrant provided by criteria satisfies Tyler Burge's de-intellectualized description of a *a priori* entitlement.⁸ I should add that I talk of a 'partial' warrant, since (here) warrant is something one can have more or less of. The satisfaction of further criteria adds to one's total warrant.

Since the very idea of a non-truth conditional account of meaning is controversial, it is not possible to give uncontested examples of criterial concepts. To some extent the value of the criterial approach must be assessed by its fruits. And I shall argue that the criterial approach to laws is especially plausible because it avoids problems presented by the competing truth conditional accounts. Even if it is disputable, a helpful possible case might be the concept 'red.' According to John Pollock, 'It is part of the justification conditions of the concept red that something's looking red to a person gives him a prima facie reason for thinking that it is red. This prima facie reason is a brute epistemic fact, partly constitutive of the concept *red* and not derivable from anything more basic.'⁹ Pollock thinks that this supplies a partial solution to the problem of perception. Pollock also proposes, and I aim to show, that a similar, partial solution to the problem of induction is also forthcoming when we apply the same approach to the concept of law.

The explication of concepts in terms of conditions that warrant assertion means that some evidential relations are *a priori*. By no means all will be, but it is nonetheless plausible that some are, and in particular the evidential relation between instances of a law and the law itself seems *a priori*. So dark clouds are *a posteriori* evidence of impending rain, since knowing that relation requires background knowledge of a relationship between clouds and rain, knowledge that could only be gained by experience. Knowledge of a relationship between clouds and rain will be gained by observing a correlation between clouds and rain. In this case the evidence (the observed correlation) is *a priori* evidence of there being a law-like relation. One does not need further experience to tell one that some Fs being Gs provides a prima facie reason to think that there is a nomic relationship between F and G.

8 T. Burge, 'Content Preservation,' *Philosophical Review* 102 (1993) 457-89. Burge's general description of the *a priori* does not tell us where a *a priori* entitlement/warrant comes from. I contend that some comes from a grasp of the very concept being employed; but this need not exhaust the sources of a *a priori* entitlement.

9 J. Pollock, 'Nomic Probability,' *Midwest Studies in Philosophy* 9 (1984) 177-204, at 180

My view is not anti-realist in any metaphysical sense. I do not think that semantic anti-realism, a view about the way concepts get their content, has implications for the reality of things falling under those concepts. One reason why it might appear that there is a link is that it might be natural to think that if the concept of B is explained by saying that A is *a priori* evidence for B then A is the sort of thing that is cognitively accessible and so to some extent B will be cognitively accessible too. In which case semantic anti-realism would bring with it the more metaphysical anti-realism associated with verificationism. But we think that there may well be cognitively inaccessible facts, including facts about laws. This issue goes well beyond the scope of this paper, but I should say why I think that my account will not require all laws to be cognitively accessible even to some small extent. The concept of law will be explicated (roughly) as that for which its instances count as evidence. A thinker can grasp that concept in general, and *conceive* of its application to cases were it were impossible to have the evidence and so impossible to know whether there is a law. Indeed there could be a 'killer law' (akin to killer yellow) that killed any subject who came into contact with its instances. It could still be *a priori* that its instances are evidence for the law. That a subject is disposed to take instances of that law to be evidence for it could not be manifest in so taking actual instances (since they are deadly). But that disposition might be manifest in other ways, for example, by the subject's believing the law to exist in virtue of *false* beliefs in its instances, or by having thoughts of the form 'if (*per impossibile*) I knew that *p*, then that would be evidence for *q*.'

2. Application of the criterial view to laws of nature

A P-characterization of the concept of law, L, as relating two universals, F and G, is as follows:

The concept L(F,G) is that concept C(F,G) to possess which it is necessary and sufficient that a thinker, for any **a** and **b** and H, take it to be the case that:

- (i) $Fa \& Ga$ provide a (defeasible) partial warrant for asserting C(F,G);
- (ii) $Fb \& \neg Gb$ provide a full and indefeasible warrant for asserting $\neg C(F,G)$;
- (iii) Ha together with any warrant of the kind specified in (i), undefeated by a warrant of the kind specified in (ii), for asserting C(H,G) reduce any warrant for asserting C(F,G) provided by $Fa \& Ga$, to the extent that there is no or little (undefeated) warrant of the kind in (i) for asserting C(H,F) or C(F,H).

Let us see why this P-characterization is appropriate. Condition (i) says that an instance of something's being both F and G is evidence for a nomic relation between the universals F and G: an individual who has a high salt diet and high blood pressure is evidence for a nomic relation between salt and high blood pressure. Condition (ii) says that no law has a counterinstance — if Fb but $\neg Gb$ then there is no law $L(F,G)$: an individual with a salty diet but low blood pressure shows that there is no strict law that salt raises high blood pressure. Since counterinstances are ruled out by (ii), the law entails the corresponding regularity.¹⁰

Condition (iii) details what sort of fact counts as defeating the evidence provided by an instance of a's being both F and G. If something else, H_a , might explain a's being G, then that reduces the warrant provided by a for thinking $L(F,G)$. The need for this condition is made apparent by cases of explanatory pre-emption. In Achinstein's famous case, Jones's death seems to be explained by the law that eating one pound of arsenic leads to death within twenty-four hours, since he indeed ate one pound of arsenic one hour ago.¹¹ But in fact he was run down by a bus. Since his death is not explained by the law, his death fails to provide confirmation for the hypothesis of such a law, once we discover the fact about the bus. Imagine another case, where we have a patient who has high blood pressure and who is highly stressed; we might think that this provides some warrant for thinking that stress causes high blood pressure. But if we note that the patient has a high salt diet, and we have undefeated warrant from elsewhere for asserting that salty diets raise blood pressure, then our patient is not after all such good evidence for the proposed connection between stress and high blood pressure.¹² However, not every prima facie alternative explanation need reduce the warrant. Take the last case and imagine we had reason to believe that a highly salty diet itself caused stress. So a correlation between high salt and high blood pressure would not now defeat the support lent to a putative law connecting stress and high blood pressure. Stress and salt

10 We might want to weaken clause (ii) to a non-absolute negative warrant to account for *ceteris paribus* laws.

11 P. Achinstein, *The Nature of Explanation* (Oxford: Oxford University Press 1983), 168

12 Clause (iii) need not reduce to zero the warrant provided by (i). Imagine that all observations of people under stress reveal that they have high blood pressure and that similarly all records show that people with salty diets have high blood pressure. Let Harry have high blood pressure, and be both stressed and have a salty diet. The fact that he fits into both regularities reduces the warrant he provides to each corresponding law. But he nonetheless provides some warrant for both laws. (My thanks to Hugh Mellor for pointing out the need for caution here.)

are now not competing alternative explanations of observed high blood pressure but are related explanations. This is captured by the final clause in (iii).

Imagine that we have found many cases of Fs that are Gs and no F which is not a G, for example, we have found many colitis sufferers who are anaemic and none who is not anaemic. Furthermore, we have not found other similar observed regularities in which the same observed Gs (people with anaemia who are also colitis patients) take part. This is evidence that it is a law that Fs are Gs (colitis sufferers are anaemic). That it is so needs no emphasis. But it is not *contingently* good evidence. It is not that we regard our belief in this sort of evidence as a justifying a belief in the corresponding law because we have observed a correlation between evidence like this and laws like L(F,G) or because there is some other theoretical reason for thinking that such evidence and laws are linked. So long as there are no theoretical reasons why colitis and anaemia should not be linked, a well-tested correlation is reason on its own, not requiring any theoretical backing, for thinking that colitis and anaemia are nomicallly linked. The relation between the law and the instances that support it is internal or logical. It is part of the concept of law that facts like Fa&Ga, etc. count as evidence for its being a law that Fs are Gs. Now imagine that with a God's eye view we see that there is a regularity that Fs are Gs, then that would be correspondingly better evidence that L(F,G); this is a conceptual fact.

The criterial P-characterization of the concept of law, as given above for laws relating properties, can be extended to functional and probabilistic laws in way that dovetails with Pollock's conception of nomic probability, according to which we should 'seek characterizations of our probability concepts in terms of their justification conditions, i.e. in terms of their role in reasoning' (180).¹³

3. Criteria and induction

The criterial account makes it the case that as part of the concept of law certain facts count as evidence for the claim that there exists a corre-

13 Apart from my use of criteria, the two approaches differ in that I introduce the concept of law by the criteria that justify its use, while Pollock explains nomic probability in terms of the propositions that are *justified by* use of that concept. Maybe this is not a deep contrast, since the requirement of harmony between introduction and elimination rules extends to criteria. Note that Pollock's own example of the concept 'red,' which I mention above (516), follows my approach, in that the 'red' is explicated by the criterial conditions that license its use (rather than by the assertions licensed *by* its use).

sponding law. Hence it can be a conceptual truth that someone who infers a law from such evidence is justified in so doing. This is why, as Strawson has pointed out, it may be *a priori* that someone who adopts the conclusion of a well-constructed inductive argument thereby makes a reasonable inference.¹⁴ If we observe a regular correlation and if we seek but fail to find grounds for defeating this criterial evidence (by testing the correlation in a variety of circumstances or by comparing alternative explanations of the phenomena) then we have a good inductive argument. One difference (among several) with Strawson is that I locate the basis for this view not in the concept 'reasonable' or 'justified' but rather in the concept 'law.'

This is not a solution to the problem of induction if that problem is phrased in this way: 'Can our evidence provide us with a guarantee of inductive knowledge?' For the skeptic will point out that I have admitted that it is possible to have the strongest possible criterial evidence for there being a certain law, yet there be no such law. Since it would still be rational for us to infer a law under such circumstances, there seems to be no guarantee that inductive rationality will yield success in generating knowledge of laws. Furthermore we will not know whether our rational arguments have succeeded in detecting laws or have just given us the appearance thereof.

The skeptic's requirements are too strong. There is no guarantee of anything if there are no laws. All we can ask is that if there are laws of nature then we can have knowledge of them through our inductive practices. Nor should we be obliged to be able to show that this is the position we find ourselves in. If under the circumstances (and circumstances appropriately like them) someone's inferential practices are sufficient to yield true beliefs, then those practices are knowledge generating. It is a distinct question whether that person has also subjected his practices to scrutiny in order to have true beliefs about them.

This is a standard externalist view of knowledge. If there are laws, then they will make an inductive practice like that described above a reliable practice as regards detecting those laws themselves. One of the concerns about externalist epistemology is that it seems to downplay the role of reason in knowledge gathering, where by 'reason' is meant something which can be assessed by looking at the *a priori* relations of a person's beliefs, observations, conjectures, and so forth. To ignore this element in the notion of justification would seem to put the reflective thinker on a par with the careless fool. Which one of these is more justified in their

14 P. Strawson, *Introduction to Logical Theory* (London: Methuen 1963) 256f.

methods of truth-seeking will depend only on the vagaries of the way the world turns out and not upon the *a priori* reasonableness with which those methods were selected.

There are various reasons why this view of externalism is misleading, but in this case we can see that in any case the criticism does not bite. Externalism about knowledge may be combined with a full or partial internalism about justification. In this case, while it is the way the world is that which will make the method reliable or not, there are *a priori* grounds for assessing these methods too. The two are linked. Not in the way that the skeptic challenges one to demonstrate — that the *a priori* reasoning guarantees the success of the method (this cannot be). Rather the link is that if there is a law, and so the possibility of a reliable method of detecting it, then *a priori* reasoning will tell us what form that method takes. This is because the criterial relation between evidence and law is *a priori*.

III The Criterial Account Versus Regularity Theories

1. Criteria and the Ramsey-Lewis systematic account

The criterial view has some affinities with the best of the regularity views — the Ramsey-Lewis systematic account — but the differences are to the advantage of the criterial account. Lewis's view is that

(R-L) A contingent generalization is a law of nature if and only if it appears as a theorem (or axiom) in each true deductive systems that achieves a best combination of simplicity and strength.¹⁵

The benefits in this approach are that it avoids the obvious pitfalls of the naive regularity view, it explains laws in terms of their instances, and it reflects our epistemic preferences, since it is true that we seek laws that integrate with one another and which show the virtues of logical strength and explanatory simplicity.

Even so, there seems something ad hoc about this formulation, as if it were designed to match our epistemic preferences rather than explaining them. In this respect, the criterial view has an initial advantage, since it can explain why we would give greater epistemic warrant to a theory of total current evidence that obeyed (R-L) than to one which violated it.

15 D. Lewis, *Counterfactuals* (Oxford: Blackwell 1973), 73

To see why a *systematic* approach is to be expected, we must focus on condition (iii) of the P-characterization of the concept of law. The gloss I gave is that alternative nomic explanations of why *a* is *G* undermine warrant provided to the putative law $L(F,G)$ by *a*'s being both *F* and *G*. But this gloss employed concepts not strictly mentioned in the condition, indeed concepts like 'law' and 'explanation' that the account is supposed to illuminate. Instead the condition refers to other applications of the self-same set of conditions. Thus use of the concept of law may in principle require iterated applications of conditions (i)-(iii) throughout one's evidence. In effect this means that one's application of the concept of law will tend, again in principle, to be holistic. The warrant provided by one piece of evidence will depend on how the warrant it might provide relates to the warrant that might be provided by other pieces of evidence.

Simplicity features in the (R-L) account for two reasons. First, it is clearly an epistemological desideratum; secondly, it is required in that account, along with systematization, to eliminate accidental regularities. Imagine that all *F*s are *G*s but every *G* was also subsumed under some other regularity. Then adding ' $\forall x(Fx \rightarrow Gx)$ ' to an (R-L) system would detract from simplicity. On the criterial view, condition (iii) outlaws accidental regularities, since such a regularity may be barred from being a law by providing independent explanations of all the individual instances of the regularity. These explanations show the regularity to be accidental. If for every instance of a positive warrant from condition (i) there is also a corresponding reducing warrant from condition (iii) we would have little or no reason to think that there is a law that *F*s are *G*s and a strong reason to think that the regularity that all *F*s and *G*s is purely accidental.

Rather than being built into the criterial account of laws, simplicity emerges from it, in the form of a preference for fewer laws over many. The holistic nature of the application of the criteria (i)-(iii) means that warrant for one putative law connects with the warrant for others. There might be different ways in which one could distribute warrant among possible laws. Consider a set with many putative laws. On average each putative law will have fewer instances and so receive correspondingly less warrant. A set of fewer putative laws each with more warrant is clearly overall better warranted. Secondly, if there are many putative laws it is likely that certain facts are potentially subsumable under more than one. According to condition (iii) this means that the laws in question reduce each others' warrant. A simple system is thus on this ground also likely to be better warranted than a complex one.

The systematicity found in the Ramsey-Lewis approach emerges from the holistic nature of the criterial view, while its preference for simplicity is generated by the way this holism distributes warrant. What about the

(R-L) desideratum of logical strength? The criterial view does not provide this. But I am not sure it should, since I am inclined to deny that it is a conceptual truth that of two equally simple putative laws that subsume the same actual facts, the one that is logically stronger is the one that is or is more likely to be the true law.

One issue that confronts the systematic regularity theorist is how to react to the possibility that there may be distinct systems that are equally optimal. Laws cannot be those regularities that are entailed by any one of the equally optimal systems, for then conflicting counterfactuals would be supported by laws from different systems. Lewis's proposal is that a law is a regularity whose statement occurs as a theorem in all the optimal systems. This is unsatisfactory in that it leaves open the possibility that even though the world may be a very regular place, the existence of widely different way of systematizing the world might mean that the proportion of the world actually governed by laws, as defined by Lewis, is very small.

But on the criterial view this problem does not arise. Imagine that E is the set of all particular facts, and that this set is systematized equally well by two systems, A and B , of which the would-be laws are $\{a_1, a_2, \dots\}$ and $\{b_1, b_2, \dots\}$ respectively. Imagine that some God-like individual, S , had knowledge of E (but no direct knowledge of which the laws of nature are). On the criterial view E provides S *both* with the best possible justification for the belief that a_1, a_2, \dots are the laws of nature *and* the best possible justification for the belief that b_1, b_2, \dots are the laws of nature. Overall we want to say that we would have the best possible justification for the belief that a_1, a_2, \dots are the laws of nature, were it not for the possibility of systematization à la B and also that we would have the best possible justification for the belief that b_1, b_2, \dots are the laws of nature, were it not for the possibility of systematization à la A . But there is no contradiction in this. It just is the case that no decisive evidence is available in these circumstances.

There might be some suspicion that this view is no different from that of a regularity theorist who claims that in the case of equally good systems there is no determinate fact of the matter as to which system represents the laws. This is the sort of position which the (semantic) anti-realist might be accused of adopting in general to verification-transcendent propositions. But I don't think every semantic anti-realist has to accept this. The regularity theorist has adopted a truth conditional account of what it is to be a law. On the original proposal, this is as follows: X is a law iff it is a consequence of the optimal (R-L) system. Now this involves a definite article (*the* optimal system), so if uniqueness fails, then the proposal fails to specify truth conditions at all. Amendment (1) X is a law if it is a consequence of *some* optimal (R-L) system allows in conflicting laws; and Lewis's amendment (2) X is a law if it is

a consequence of *all* optimal (R-L) systems is too restrictive. The criterial account suggests the following is close to the truth:

(C) the criterion (*prima facie* best possible justification) for X's being a law is that X is a consequence of some optimal (R-L) system.

As argued above, this is part of the explanation of the meaning of 'X is a law.' *A fortiori* we have an explication, in the above case of 'a₁, a₂, ... are the laws of nature' and of 'b₁, b₂, ... are the laws of nature' and also of the disjunction 'either a₁, a₂, ... are the laws of nature or b₁, b₂, ... are.' Given the minimalist explication of truth and fact as consequent upon meaning, we can also say we have an explication of 'it is a fact that either a₁, a₂, ... are the laws of nature or b₁, b₂, ... are.'

Furthermore, I think we can say that, from a God's eye view, we would have the best possible evidence for the assertion that either a₁, a₂, ... are the laws of nature or b₁, b₂, ... are. For although we are dealing with criterial evidence and justification it remains the case that the normal logical features of evidential support and justification remain. That is, in this case, if X and Y are incompatible claims which are equally well supported by the evidence and better supported than any possible competing claim, then their disjunction is better supported than any competing claim.

This also explains why, despite the presence of the indefinite quantifier *some* in (C) above, that the same incoherence does not arise as in the amendment (1) to the regularity theorist's truth conditional explanation. For the truth conditional explanation entails that X is a law if it features in some optimal system, while the criterial explanation entails only that there is justification for the assertion that X is a law. While it is incoherent for both X and Y to be laws if they are incompatible, it is not incoherent to have (defeasible) justification for the claims that X is a law and that Y is a law. (For instance, if an experiment provides evidence that the value of some constant G lies between 20 and 30, then the experiment provides evidence for both the incompatible theories, that G lies between 20 and 25, and that G lies between 25 and 30.)

The probabilistic version of the criterial view also has advantages over the R-L approach. The long-run frequency and objective chance must come apart, at least in modal contexts. But the R-L approach does not permit this. The criterial view does, since it allows for an ontological gap between the probabilistic law (and so objective chance) on the one hand and the long-run frequency on the other. Even so, as the criterial view also asserts, a long-run frequency is the most warranted (but defeasible) estimate of the objective chance.

2. Explanation and regularity

In section III.1 I argued that the criterial view has affinities with the Ramsey-Lewis account of laws but also important advantages over it, primarily due to its anti-realist semantics. In this section I will argue that a more general problem afflicts any regularity account — namely that no regularity account may satisfactorily account for the intuition that laws may explain their instances. To allow for the possibility of explanation laws must be distinct from regularities. The criterial view then has the advantage that it allows for such an ontological gap.

Facts may explain other facts but they cannot explain themselves. This will be a central assumption of following argument. Its gist is this. I have a gem stone and find that it is very hard. I look for an explanation of its hardness. The simplest explanation available is that this stone is a diamond and that it is a law that diamonds are hard. There are of course other more sophisticated, deeper explanations that will appeal to the underlying structure of diamond. But these explanations too will appeal to laws that link that structure to hardness and also to the fact that this stone instantiates that structure. Let us stick then with the simple explanation. Would it be explanatory to cite the *regularity* that all diamonds are hard? One instance of this regularity is the fact that *this* diamond is hard. But by our assumption it cannot explain itself. So does the remainder of the regularity provide the explanatory power? No — since all that the remainder says is that other diamonds are hard. The fact that some other diamond is hard does not explain why this diamond is hard.¹⁶ In this section I shall attempt to give this argument some precision.

The argument I employ rests on the notion of the *ontological content* of a fact or set of facts (a notion related to that of ontological commitment). If we allow that there are complex facts that have simpler or more basic facts as constituents then the latter are included in the ontological content

16 Armstrong (*What is a Law of Nature?*, 40) gives an argument of this kind: he says that the complex fact that all Fs are Gs cannot explain the fact that all observed Fs are Gs since the latter fact is part of the former one. All Fs are Gs = all observed Fs are Gs and all unobserved Fs are Gs. By the assumption stated the first conjunct does not explain why all observed Fs are Gs. Nor could the second conjunct. Therefore the conjunction does not. And so the fact that all Fs are Gs does not explain why all observed Fs are Gs. But we do want it to be possible that the law that Fs are Gs explains why all observed Fs are Gs. Hence the law cannot be identical with the regularity. Clearly the notion of observability is otiose to Armstrong's argument. On the one hand the fact that all Fs are Gs is itself something which may be explained by its being a law that Fs are Gs, and on the other hand, Armstrong's argument may be adapted, as I do, to show that a regularity cannot explain any single instance of it (whether observed or not).

of the former.¹⁷ In the simplest case, a conjunctive fact has the combined ontological content of its conjuncts. For one fact to explain another it must have an appropriate ontological content. The idea I shall be making use of is the following: if the content of the fact A includes the content of B, then if B explains E, then A has sufficient ontological content to explain E. The converse is that if A does not have enough content to explain E then B cannot explain E. Part of the point of talking about ontological content is to avoid the subtle question of whether conjunction with another, irrelevant, fact reduces a fact's explanatory power: if the fact that Vesuvius erupted explains the destruction of Pompeii, does the conjunctive fact that Vesuvius erupted & Krakatoa erupted also explain the destruction of Pompeii? Whether or not the conjunctive fact does explain what is explained by one of its conjuncts, it is clear that the content of the conjunction has sufficient ontological resources for such an explanation.

I have not said enough for it to be clear in every case what the ontological content of a fact is. The case of conjunction looks easy. But we cannot say that the ontological content of a fact P includes the content of every fact entailed by P. For the fact of my knowing that Vesuvius erupted entails that Vesuvius did erupt. But we may not want the ontological content of the former, which is a current state of my mind, to include the latter, which was a past state of a volcano. Nonetheless, the notion is clear enough for application in particular cases. I shall also employ a related idea concerning the content of the explanandum rather than the explanans. If A has the ontological resources to explain E, and the ontological content of F is included in that of E, then A has the resources to explain F; in particular, if A has the ontological resources to explain E&F then A has the resources to explain E.

Now consider the following facts:

(1) $Fa_1 \& Ga_1 \& Fa_2 \& Ga_2 \& \dots$

(2) $a_1, a_2, \dots, a_n, \dots$ are all the Fs that there are.

(1) and (2) jointly entail the regularity *all Fs are Gs*. (Note that (2) is equivalent to: (2'): nothing is F other than $a_1, a_2, \dots, a_n, \dots$) Clearly the entailment does not hold in reverse; (1) tells us that some things are indeed F and G and furthermore tells us which they are — these are facts

17 In an atomistic metaphysics — which this paper does not endorse — we might identify the ontological content of a fact P with the facts corresponding to the propositions that are the conjuncts when P is expressed in conjunctive normal form.

left out of the regularity. So the conjunction of (1) and (2) amounts to more than the regularity — the conjunction has greater ontological content.

I shall argue that the conjunction (1)&(2) does not have the ontological resources to explain the instances of laws that laws ought to be able to explain. Therefore, since (1)&(2) does not have sufficient ontological content for explanation, the regularity *all Fs are Gs* cannot have enough either.

Let it be that we want to explain why a_1 (this gem stone) which is F (a diamond), is also G (hard). Again, it is not entirely clear what the explanandum is. The fact requiring explanation is that Ga_1 , conditional on the fact that Fa_1 . I propose that there are at most three possibilities that would be acceptable to the regularity theorist:

- (i) explanandum: $Fa_1 \& Ga_1$ explanans: all Fs are Gs
- (ii) explanandum: $Fa_1 \rightarrow Ga_1$ explanans: all Fs are Gs
- (iii) explanandum: Ga_1 explanans: all Fs are Gs and Fa_1

In none of the cases can in fact the explanans do the job asked of it. In accordance with the above remarks, I shall show that as regards (i) and (ii) the ontologically weightier (1) & (2) cannot provide an explanation of the explananda, and similarly in the case of (iii), (1)&(2)& Fa_1 cannot. Correspondingly the weaker explanantia listed above cannot.

Let us consider (iii) first. This the form of explanation advocated by Hempel¹⁸ and is perhaps the most promising suggestion. The explanans, (1)&(2)& Fa_1 , is equivalent to the conjunction of:

- (P) Ga_1
- (Q) $Fa_2 \& Ga_2 \& Fa_3 \& Ga_3 \dots$
- (R) $a_1, a_2, a_3 \dots$ are all the Fs there are
- (S) Fa_1

(P) is identical to the explanandum and so must be irrelevant to the power of the explanation. We should be able to ignore (P) without losing explanatory power. (Q) consists of facts about a_2, a_3 and so on, which do not bear on a_1 ; hence we should be able to exclude (Q) without loss. (R),

18 C.G. Hempel, *Aspects of Scientific Explanation* (New York: Free Press 1965)

being simply about which Fs there are does not contribute to an explanation of why a_1 is G. Lastly, (S) the fact that a_1 is F might well contribute to the explanation of a_1 's being G, for instance if F ness necessitates G ness. But in the absence of any other fact which has potential explanatory power, a_1 's being F is by itself impotent to explain why a_1 is G. Hence $(1) \& (2) \& Fa_1$ does not have the resources to explain Ga_1 . And so neither does the explanans in (iii), since that is entailed by $(1) \& (2) \& Fa_1$.

Considering (i) in the light of (iii), we can see that (iii) has an ontologically stronger explanans than (i) and a weaker explanandum. Hence if there is no explanation in (iii) then there is none in (i) either.

In (ii) the explanans, all Fs are Gs, is simply the universal generalization of the explanandum, $Fa_1 \rightarrow Ga_1$. Consider the proposition:

(T) $(Fa_1 \rightarrow Ga_1) \& (Fa_2 \rightarrow Ga_2) \& \dots$ & there is nothing other than a_1, a_2, \dots

This entails that all Fs are Gs. By an argument parallel to the one above, (T) cannot explain why $Fa_1 \rightarrow Ga_1$, and so neither can the weaker proposition that all Fs are Gs.

And so on none of the three views of what the explananda and explanantia are in nomic explanation does the proposed explanans have the power to explain the explanandum.

This objection covers all the forms of the regularity theory, not just the simple regularity theory. The natural way to take sophisticated regularity accounts is as saying the following: (a) every law is identical to some regularity; (b) not every regularity is identical to some law; (c) the regularities that are laws are distinguished from those that are not by some factor X. Clause (a) means that the ontological content of laws is the same as the ontological content of regularities, for the sophisticated regularity theorist. And so the objection carries across. The fact that the sophisticated regularity analysis now includes reference to factor X does not have to be taken as adding any ontological content, and so does not add explanatory power. (Compare 'M is a precious metal': 'precious' does not add anything to the causal powers ascribed to M beyond 'M is a metal'.)

Even if we do think of factor X as adding ontological content to a regularity, so a law does have more content than the corresponding regularity, that will not help. For instance, the deductive integratibility required by Lewis does not serve to provide any more explanatory power to a law than is provided by a regularity. That the regularity is an axiom or consequence of the optimal axiomatic system does nothing to change the fact that it cannot explain its instances.

None of this is to deny that in searching for an explanation of why this F is also a G it may be very useful to be told that all Fs are Gs, since the

fact that this is so suggests that it is a law that Fs are Gs and so points in the direction of an explanation. A visitor from Africa who had never seen leaves turn yellow and fall from trees in autumn might ask for an explanation and might be satisfied to be told that this happens every year at that time. This is helpful since it suggests that the explanation has something to do with the seasonal variation in climate or perhaps with some biological clock. The stated regularity rules out other possible explanations, such as a disease causing the fall of leaves. Furthermore, mentioning the regularity may usefully serve to correct a false presupposition of the question, that the phenomenon is somehow uncommon or surprising. But to rule out certain explanations or to show that a phenomenon is not unusual is not to provide an explanation.

3. Generalization and induction

If regularities do not explain their instances, then a question is raised about induction. Inductive arguments are often characterized as arguments of the form: All observed Fs are Gs therefore all Fs are Gs, or, All observed Fs are Gs therefore the next F to be observed will be a G. Inductive inferences are often of this sort, but where these inferences are justified, I claim, an inference such as All observed Fs are Gs therefore it is a law that Fs are Gs, is also justified. As Armstrong (*What is a Law of Nature?*) and Foster have said, inductive generalizations are instances of inference to the best explanation.¹⁹

As we saw when discussing regularities and explanations, a regularity on its own cannot explain its instances. This is because a regularity has no more explanatory power than a collection of its instances and such a collection does not require any intimate connection among those instances. Similarly, the simplicity or 'uniformity' of a statement of a regularity, the generalization that all Fs are Gs may well suggest something uniting the instances. But a generalization does not of its own accord mention a unity. One might think that all Fs are Gs *because* something's being an F necessitates or causes or secures its being a G. But the latter is more than the former.

19 Foster, for example, says that an extrapolative inference is an inference to the best explanation (to a law, where laws involve natural necessity) and then a deduction from the law that the observed regularity will continue to hold ('Induction, Explanation and Natural Necessity,' *Proceedings of the Aristotelian Society* 83 [1983], 90). Foster also remarks that the inference to the law may be justified in a way that a direct inference to the regularity is not precisely because of the greater content and explanatory power of the former (88-91).

Goodman's new riddle helps us see the link between explanation and induction.²⁰ For one effective way of seeing why regularities do not explain their instances is to employ a Goodman-like argument. Let 'emerire' be defined with respect to emeralds and sapphires just as grue is defined with respect to green and blue. Assuming that, nomically, all emeralds are green and all sapphires blue, it is true that all emerires are grue. We have a mongrel regularity, one that is formed from parts of two independent regularities being spliced together. Clearly we do not regard this as a genuine law and cannot expect it to explain its instances. But it bears to its instances precisely the same relationship that the fact that all emeralds are green bears to its instances.

It is scarcely surprising then that we should be so troubled by Goodman's riddle. For if the regularity that all emerires are grue bears the same non-explanatory relationship to some emerald observed to be green, that the regularity that all emeralds are green bears to that observation, then we should not expect that observation to confirm the *hypothesis* 'all emeralds are green' any better than it confirms 'all emerires are grue.' This allows us to see what will not be successful as a route to solving Goodman's riddle. No solution which simply seeks to limit enumerative induction to instances employing some restricted set of predicates (ones excluding predicates like *grue* and *emerire* from above) will be adequate. For the restriction of inductive inferences to those employing e.g. entrenched, projectible predicates is like the restrictions placed on regularities by sophisticated regularity theorists; the restriction to certain sorts of predicate serves only to restrict the class of acceptable inductive inferences. This strategy will fail to give a full answer to the problem. This is because in focusing on predicates, it fails to address adequately the metaphysical question, Concerning what sort of fact can hypotheses be confirmed by a singular fact? taking it as given that the answer is that it is some class of universal generalization that gets confirmed.²¹ This approach fails to establish any link among the observed and unobserved instances of regularities which are acceptably induced that is absent in the cases where induction is unacceptable. If there is no connection between instances of a regularity, then there can be no reason to infer from certain of its instances to other instances. In

20 N. Goodman, *Fact, Fiction and Forecast* (London: University of London 1954)

21 For instance, Goodman writes, 'We may concentrate at present upon simple universal hypotheses in categorical or hypothetical form — that is, upon hypotheses ascribing a certain predicate to everything in the universe of discourse or to everything to which a certain other predicate applies' (94).

this respect hypothesis that is a restricted generalization is no better or worse than a hypothesis that is unrestricted.

On the other hand, if there is a connection between the instances of a regularity, i.e. they all instantiate the universal or property F which itself has the property of bringing about the co-presence of the property G, then we do have a justification for inferring from the observation of Fs being G that all Fs are G. The point of these remarks is not to provide a solution to either of the two problems of induction. However, they do provide some insight into the nature of induction, that the inductive schemas given above are justified only if something like the following is justified too:

All observed Fs are Gs therefore it is a law that Fs are Gs

where, furthermore, the law that Fs are Gs is more than just a regularity.

The reason is that the law provides an *explanation* of the observed instances. It is that the law provides the same explanation of the instances which provides the unity we were looking for. And because of the universal nature of laws we are also justified in inferring unobserved instances.

4. Conclusion

I first argued that the criterial view had advantages when compared directly with the Ramsey-Lewis version of the regularity theory. I then argued that any version of the regularity theory suffers from the fact that it does not allow laws to explain their instances or those instances be evidence for the existence of the corresponding laws. What is required is an ontological gap between regularities and laws, and the criterial view supplies this. It does so because it denies that the existence of any regularity or system of regularities ever entails the existence of a law. Regularities may constitute excellent *a priori*, criterial evidence for the laws, but since criteria are in principle always defeasible, the law cannot be reduced to the regularity. This view allows that existence of a regularity is logically compossible with the non-existence of the law.

IV The Criterial Account Versus Nomic Necessitation Among Universals

In considering Goodman's puzzle it looked as if we might be able to create a gap between a law and its instances by thinking of nomic explanation as involving the possession of a property that itself brings about the instantiation of another property. Such a relationship among properties

would provide a unity, rather than a mere uniformity, that is not present in regularities. Several philosophers, David Armstrong, Michael Tooley, and Fred Dretske foremost among them, have sought to expand upon this idea by suggesting that we regard laws as second-order relations of nomic necessitation among universals. In this section I shall outline an explanation of why, although this approach succeeds in opening up the ontological gap, it does so in such a way that it is impossible adequately to characterize the second-order relation(s) in question. The non-existence of a gap for the regularity theorist make his conception of law semantically easily accessible — it requires no more conceptual apparatus than is needed to understand particular instances (plus generalization). But the gap in the case of the second-order relation approach is too wide — the supposed relation is semantically and epistemically inaccessible.

1. Tooley, Armstrong, and nomological relations

It is all very well saying that laws are second order relations of nomic necessitation among universals, but for this to be an explication of the concept of law, we need to be told more about what nomic necessitation is. After all, 'all instances of X are instances of Y ' (where ' X ' and ' Y ' are variables for universals) is a second-order relation among universals, but of a kind that is entirely permissible to regularity theorists (so long as they admit universals). The most promising proposal is that we regard nomic necessitation as a theoretical concept, a proposal that is explicit in Tooley, 'The Nature of Laws,' and perhaps implicit in Armstrong, *What is a Law of Nature?* Tooley employs David Lewis's explication of the notion of a theoretical concept. A theoretical concept t is defined by the theory $T(t)$ as that unique entity which satisfies $T(x)$. Hence ' t ' refers only if precisely one entity satisfies $T(x)$.

Applied to the concept of nomic necessitation, this means that an explication of the concept requires the specification of a theory. Furthermore, to the extent that we think there actually are laws, we ought to have reason to think that the theory in question is uniquely satisfied. If the theory is not uniquely satisfied, then 'the second order relation of nomic necessitation' will fail to refer, and so there would not be any laws.

Strictly speaking, as Tooley permits, there will in fact be more than one second-order relation of nomic necessitation, since there will be a 3-ary nomological relation that is different from the 2-ary relation, and so on. These will be defined by different theories. For simplicity, let us stick with the 2-ary relation. The theory Tooley gives us which would characterize binary nomic necessitation, N , is:

- (N1) N is an 2-ary relation among universals
- (N2) N is irreducibly of order 2, relating universals of order 1 (i.e. N is irreducibly a relation which relates universals which take particulars as instances).
- (N3) N is a *contingent* relation among universals
- (N4) the proposition that $N(F, G)$ logically entails the proposition $\forall x(Fx \rightarrow Gx)$.

Does this successfully fix the concept of (binary) nomic necessitation? There are various problems associated with the kind of theory this is. Lewis's account of theoretical terms is concerned with concepts introduced through *explanatory* theories. But Tooley's theory cannot be an explanatory theory precisely because any appeal to explanation will be an implicit appeal to concepts such as 'law' or 'cause' which are the very concepts requiring explication. So the theory must be some sort of transcendental theory. This raises questions about its epistemology. But more worrying is the concern that we have no reason to think that if N is instantiated at all it is uniquely instantiated. In the case of an explanatory theory we may have evidence that there is a unique satisfier of the theory. In the case of a non-explanatory theory we may have a proof that there is a unique satisfier. For example, we might introduce the concept of *conjunction* by characterizing it as the unique logical connective C for which the following are all true $C(p, q) \Rightarrow p$; $C(p, q) \Rightarrow q$; $p, q \Rightarrow C(p, q)$; it can be proved that there is only one connective satisfying this open sentence. Can we do the same for N?

Let N^* be a binary relation irreducibly of order 2 which entails the corresponding universal generalization. Why should there not also be some distinct N^\dagger of which the same is true? It would be satisfying if we thought that there were a minimal realization of N, one which is entailed by any realization of N. But there is no reason given by Tooley to suppose that there must be relations of entailment between N^* and N^\dagger , or that they both entail some third realization. Lewis argues, and Tooley concurs, that in cases of multiple realization the theoretical term does not refer. Since we have no reason to think that (N1)-(N4) are uniquely realized then we have no reason to think that 'N' does indeed refer. If 'N' does indeed explicate and 'N' failed to refer, then 'the law that ...' would always fail to refer — there would be no laws of nature. While knowledge of laws is difficult, this account makes it rather more difficult than we ever supposed.

2. Conclusion

While the regularity theorist suffered from too thin a concept of law, the nomic necessitation approach suffers from too thick a concept. That makes the ontological gap too broad for an epistemic bridge to span. It seems that we need something in between. Armstrong says that 'in rejecting regularity theories we are committed to nomic *necessity* in some form or another,' but what we are really committed to is the existence of an ontological gap between laws and regularities. Because this will require an ontologically irreducible second-order concept, it may be that we will wish to call the appropriate concept 'nomic necessitation.' However, its semantics will have to be importantly different from the semantics provided by Tooley.²² For his semantics of the irreducibly second-order concept of nomic-necessitation constitutes a theory that will be underdetermined in an especially radical way by evidence that is only ever first-order.

One way of looking at my criterial proposal is to regard it as agreeing with Armstrong and Tooley that laws involve nomic necessitation among universals but as giving a different account of nomic necessitation. My account *explains* the concept in first-order terms, in terms, that is, of the first-order facts that license the assertion that there is a relation of nomic necessitation. Because the account is anti-realist this is consistent with such relations not being reducible to any first-order facts.

V Criteria, Symptoms, and Theoretical Terms

The criterial view which I have discussed here in detail I first outlined in *Philosophy of Science*.²³ In his review of the latter, Peter Lipton has raised an important criticism, which it will be useful to address here. This criticism centers on the contrast between the criterial relation and the non-criterial evidential relation. The key question is: What distinguishes the former from the latter? When is it that a's being both F and G is criterial for L(F,G) rather than a *symptom* of the law L(F,G)? The challenge is that if there is no principled way of telling the two apart, then, since symptoms are acknowledged and accepted but criteria are contentious,

22 Armstrong's and Tooley's positions are also subjected by John Carroll (*Laws of Nature* [Cambridge: Cambridge University Press 1994], 161-74) to criticisms that tend in the same direction as those presented here.

23 A.J. Bird, *Philosophy of Science* (Montreal: McGill-Queen's University Press 1998)

it seems at the very least safer to regard any evidential relation as symptomatic and not criterial.

It would be simple, but too simple, if the distinguishing feature were some appropriate conceptual, *a priori* connection that is present in the criterial but not in the symptomatic case. However, this is not enough. For while the fact that a relation is both evidential and conceptual is necessary for that relation's being criterial, it is not sufficient. This is because both those features are present where the application of a theoretical concept is concerned. Davidson's old example of 'the cause of X causes X' show how a proposition may both be causal and known *a priori*, and the same example will allow us to see that the presence of X may be both be evidence for the existence of 'the cause of X' and conceptually connected with it. In science many concepts are introduced, at least implicitly, as 'that which causes or explains phenomenon X.' Let 'Y' be introduced in such a way. The presence of X is clearly evidence for the presence of the causally more basic Y (phosphorescence in the cathode ray tube is evidence for the presence of electrons, where the concept of 'electron' may be understood to have been introduced as 'that which explains phosphorescence in the CRT'). However, the way the theoretical concept is introduced establishes a conceptual connection between the symptom and the theoretical entity for which it is symptomatic. Lipton's challenge comes down to this: how do we distinguish criterial from theoretical concepts?

Some scientific anti-realists may welcome the suggestion that we take theoretical relations to be criterial. But I do not think this is a satisfactory approach. For science often gives us an independent handle on the underlying entities and properties. There are other ways of detecting electrons. For things belonging to some theoretically introduced kinds, observation may be a way of detecting them. Let X be criterial for Y and R be criterial for T. Since the natures of Y and T are constituted by these distinct relations, it is difficult to see how science could establish an identity between them. Conversely, if science did establish an identity between Y and T, it would be difficult to think of X and R both being criterial — one or other would have to be symptomatic.

Lipton's challenge is thus an important and difficult one. The answer must be, I suggest, as follows. If a concept is theoretical, then application of that concept involves commitment to the theory implicit in the concept. That theory might be false. Science even might show it to be false. In such circumstances the concept has no extension. There is no phlogiston or aether. Thus if 'Y' is a theoretical concept introduced by the symptoms X, then we must be open to the possibility that science shows that there are no Ys (however many favorable Xs there are). In general, if Ys are theoretical, we must be open to the possibility of eliminativism with respect to Ys. This is a mark of symptoms which is lacking as

regards criteria. It is true that criteria are defeasible, but the defeasibility of criteria is not a matter of falsifying an implicit theory.

Let me illustrate this by reference to a simple example used to explicate the concept of criterion in *Philosophy of Science* and referred to by Lipton. I suggest there, in a Wittgensteinian vein, that the relation between certain behavior (e.g. eating with gusto) and the state of hunger, is criterial. An alternative, functionalist, view is that the relation is symptomatic and that behind the use of the concept 'hunger' is a simple theory, to the effect that there is some state of the mind or body which causes the relevant behavior, and which we call 'hunger.'

Which view of the concept is correct? Note that for my purposes it does not matter particularly that hunger should come out as a non-theoretical criterial concept. My purposes require only that I give some indication of what makes the difference between things turning out that way as opposed to the alternative. In this case, we must ask whether our employment of the concept 'hunger' commits us to a theory that asserts that hunger is a state that causes the behavior (e.g. eating with gusto). Note that there is no question of the criterialist (about hunger) being required to deny that something does cause the behavior. The criterialist may well accept that states of the stomach and mind cause the behavior. What the criterialist must deny is that the causal states are identical with the hunger. The criterialist might seek to establish the position as follows. As discussed, the symptomatic view must be open to the possibility of eliminativism. Say science, despite its best efforts, was unable to identify any set of conditions satisfied by all and only those people who are hungry. Would we regard that as reason to give up all claims to the effect that people are hungry? If not, that counts against the symptomatic view and in favor of the criterial view. To be sure, the debate would not then be over, for symptomatic view might adopt some token identity thesis or most sophisticated version of functionalism. But, in general, such views must allow some possibility of eliminativism, and it may be that the intuitive implausibility of eliminativism is due to the thought that neuroscience just has nothing to tell us (at the general level) about whether people are hungry or angry or whatever. This rejection of eliminativism would be natural on the criterial view but not on the symptomatic alternative.²⁴ On the other hand we think there is strong

24 This debate turns, in part, on speculation about what people would say in the face of scientific discoveries of a certain sort. The current employment of a concept may not determine the outcome and other factors may influence future usage. For this reason, the distinction between criteria and symptoms may, as Wittgenstein realized, be somewhat fluid. Note that the rejection of scientific eliminativism for

evidence for the existence of neutrinos. This evidence is symptomatic since we must concede that further developments could in principle show that these bosons do not exist (even if we doubt it in practice). Other cases go the other way. Astrologers have grounds for classifying people as Scorpios, Librans, and so on. These are not theoretical concepts, since one can agree, without accepting any theoretical beliefs of astrologers, that a person could be a Scorpio.

Other cases might be less clear cut. The Azande had different grounds for classifying some people as witches. On the one hand there were tests requiring the poisoning of chickens. On the other hand the suffering by someone of an undeserved misfortune was also a ground for a witchcraft accusation. The former ground is clearly symptomatic since the concept of witch was tied to that of malevolence, not to that of the test outcome. The ground of undeserved misfortune might be either symptomatic or criterial, since there is a conceptual connection between harm and malevolence. Evans-Pritchard could follow such grounds for witchcraft accusations although he took them also to be symptomatic, regarding witchcraft beliefs as constituting a false theory. While there is considerable evidence for this point of view, there are others who deny this. Wittgenstein in particular argued that we should not regard the practice as being founded on a (false) theory. Rather the practice is self-standing and the discourse helps co-ordinate the practice. The content of the corresponding concepts must be understood accordingly. On this view we should understand 'witch' not as designating a theoretical causal agent of misfortune but rather as characterizing targets of certain sorts of inter-personal suspicion, so that a witchcraft accusation is more akin to accusing someone of a certain sort of malevolence. Which way we should see things depends on how the practice relates to other practices and beliefs. If the practices are largely self-standing then there is room for the latter interpretation. If witches are burned, then it is reasonable to suppose that they are thought to be genuine agents. Interestingly the appropriate reaction among the Azande to suspected witchcraft was vengeance-magic. Similarly, if a practitioner feels that the practice is in competition with the deliverances of science, then the practitioner regards his concepts as theoretically loaded. But if there is room for co-existence then that is reason to suppose that the concepts in question

hunger is not to say that necessarily there is hunger. All hunger behavior could be faked. On the criterial view the defeaters for the existence of hunger must occur at the folk-psychological level, not at the physiological level.

are not theoretical and so are related criterially to their grounds for assertion.

This view does imply a pluralism about the existence of conceptual schemes, several of which may be available to a single language community. But that is not the same as a pernicious relativism. Relativism requires that a choice of conceptual scheme would entail commitment to a theory. But, for the reasons discussed, to employ a conceptual scheme governed by criterial concepts is not to buy into a theory. That is consistent with its being the case that a *particular* application of some criterial concept is hypothetical — since it might not be that the criteria are fulfilled or that they are fulfilled but are defeated, such an application might be false. Some particular X may be inferred to explain P, even though Xs in general are not theoretical entities introduced to explain P-like phenomena. One could hold that John's hunger explains his buying chocolate, even though one does not think of hunger as that hypothesized physical state which causes food-seeking behavior.

Let us apply this to the concept of law. The alternatives to the criterial view are (i) reductionism about the relation between instances and laws, and (ii) a symptomatic view of the relationship. Reductionism is, at best, some form of the regularity theory, the demerits of which have been thoroughly investigated. The symptomatic view as applied to laws says that the concept of law is introduced as part of a theory that says that laws are what explains regularities. Tooley's account of laws, as discussed above, is precisely such a view, and the criticisms leveled at Tooley's account will do for all symptomatic views of laws. A central criticism was that the view is consistent with an eliminativist claim that there is no unique binary second-order relation which explains binary first order regularities. Hence Tooley's account not only allows for the possibility that there are no laws at all, but does so in a way which means that there are no epistemically available considerations which would give reason to prefer the view that there are laws over the view that there are none (and vice versa). If the general hypothesis that there are nomological relations (and hence that there are laws) is susceptible to neither positive nor negative evidence, i.e. is undecidable in a fundamental way, then the status of claims that there are particular laws are similarly problematic. Of course these may be decisively refuted, but what we take to be positive evidence may be no evidence at all. The criterial view is far more plausible on this point. There is no metaphysically *prior* (but undecidable) question of the existence of nomological relations whose answer must be *yes* before there can be the possibility of evidence for particular laws. On the criterial view the question Are there laws? is the same question as: Is it a law that Fs are Gs or that Xs are Ys or ... ? Evidence for any disjunct may be unconditionally available in the form of regularities to which no exception has been found. Of course the

evidence is defeasible, but what defeats it is the epistemically accessible existence of a counterinstance — not the epistemically inaccessible existence of more than one second-order binary relation of necessitation.

Another reason for thinking that the concept of law cannot be a theoretical concept but is a criterial one also originates with the criticism of Tooley. Theoretical entities are hypothesized as those that explain, according to a certain theory, the existence of specified phenomena. While laws do explain their instances, it cannot be that the concept of law is a theoretical one introduced in this way. For that would require a prior understanding of the relevant general concepts used in the theory and its explanation of the phenomena (here the existence of regularities). ‘Explanation’ is one such general concept that will be employed, another is ‘cause,’ and another may well be ‘law’ itself.²⁵ Whichever general concept is used, that concept is not one which one can readily assume is sufficiently independent of the concept of law. In which case the concept of law cannot itself a theoretical concept. Rather possession of the concept of law (or one of its relations or dependents, such as ‘explanation’) will be a pre-condition of being able to introduce other concepts theoretically.

VI Conclusion

I have been arguing for the following view of laws. Laws of nature possess these properties: they explain their instances and would-be instances count as evidence for their existence. These features rule out any regularity view of law, on the grounds that a regularity cannot explain its instances and that a regularity does not possess the sort of unity required to license an inference to it from its instances. Thus the concept of law must allow for the existence of an ontological gap between it and the corresponding regularity. It must be a different sort of thing from a regularity and furthermore it must be a thing with unity. I concur therefore with the likes of Armstrong, Dretske, and Tooley in regarding laws as some sort of relation among universals that is not reducible to a regularity.

25 Papineau, for example, is explicit about the need for terms such as ‘cause’ and ‘physically necessitates’ to appear in the explication of theoretical terms. See D. Papineau, ‘Theory-Dependent Terms,’ *Philosophy of Science* 63 (1996) 1-20. These *cannot* be eliminated (and so explicated) in a Ramsey/Lewis style definition of a theoretical term.

The next issue is, then, what is this relation among universals? I have argued that Armstrong and Tooley fail to give an adequate characterization of this relation. In particular it cannot be a theoretical concept for two reasons: (i) theoretical relations are those which are understood in terms of nomic relations, the very sort of relation we are trying to understand; and (ii) there could be no reason to thinking that the relation ever holds, since there could be no reason for thinking that the theory is uniquely realized.

Instead I proposed an account of the concept of law which focuses on the precise nature of the relation between a law and its instances. This account is semantically anti-realist (but not metaphysically) in that it does not seek to explain the concept of natural law by giving necessary and sufficient conditions for the application of the concept, i.e. we do not specify the truth conditions of sentences containing this concept. Rather, what is given is a description of the circumstances which would justify use of the concept. These conditions are the criteria for the use of the concept — if they obtain that counts as evidence in favor of there being a law. Being evidence these criteria are defeasible. Broadly speaking, the criteria for there being a lawlike relation between F_{ness} and G_{ness} are instances of F_s which are G_s . Strongly defeating conditions would be cases of F_s which are not G . Weaker defeating conditions would be evidence in favor of other laws which show that the coincidence of F_{ness} and G_{ness} is accidental.

The advantages of this approach is that it demystifies Armstrong's and Tooley's relation(s) among universals while giving us what we lacked in a regularity account. In particular the law explains the instances which are criterial for it (since this is a case where explanation and evidence are converse relations). The criterial relation allows for an appropriate ontological gap between regularities and laws, permitting the latter to explain the former. Furthermore since the fact that criteria are evidence is a logical or conceptual fact, that a 's being both F and G is evidence for there being a nomic connection between F_{ness} and G_{ness} can be known *a priori*. That fact does not tell us that we can have *a priori* reasons for thinking that we do have inductive knowledge (no valid *a priori* thinking could yield a contingent conclusion such as that). But what it does show is that we can *a priori* select (some) methods of inference which will yield knowledge (on externalist grounds) if any do.

This approach, it seems to me, is the best hope for a more or less Humean approach to laws, an approach that takes laws to be contingent and the relations involved to be categorical (i.e. not essentially dispositional). The departure from Lewis and Armstrong is in the employment of an anti-realist semantics. Historically it will not be surprising that such a semantics is required to shore up what is a (very) mildly Humean,

empiricist point of view. Without it we may be impelled to give up even the mildest Humeanism about laws.

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