

PART I
A critique of the Regularity theory

Introductory



1 The importance of our topic

The question ‘What is a law of nature?’ is a central question for the philosophy of science. But its importance goes beyond this relatively restricted context to embrace general epistemology and metaphysics. In this section I will first discuss the importance of the question for the philosophy of science and then its importance in the wider context.

Natural science traditionally concerns itself with at least three tasks. The first is to discover the geography and history of the universe, taking ‘geography’ to cover all space and ‘history’ to cover all time, including future time. Astronomy is beginning to give us a picture of how the universe as a whole is laid out in space and time. Some other natural sciences give us an overview of more restricted spatio-temporal areas.

A second task is to discover what sorts of thing and what sorts of property there are in the universe and how they are constituted, with particular emphasis upon the sorts of thing and the sorts of property in terms of which other things are explained. (These explainers may or may not be ultimate explainers.)

The third task is to state the laws which the things in space and time obey. Or, putting it in the terms used in describing the second task, the third task is to state the laws which link sort of thing with sort of thing, and property with property.

It may not be obvious that there is a second task to be distinguished from the third. But consider the scientific discovery that heat is molecular motion. It is obvious that this is not a historical/geographical truth. I shall argue at a later point that it is not a law of nature, even a ‘bridge law’ (Ch. 10, Sec. 1). It is something different: it gives the constitution of a property, or range of properties, in terms of more ultimate properties. (It could be said to give the ‘geography’ of a property.)

What is true is that the three enquiries are inextricably bound up with each other. They logically presuppose each other and can only be

pursued in conjunction with each other. Nevertheless, they are distinguishable.

If the discovery of the laws of nature is one of the three great traditional tasks of natural science, then the nature of a law of nature must be a central ontological concern for the philosophy of science. As for the importance of science itself, I take its 'vanguard role' in the gaining of knowledge and/or reasonable belief about the world to be obvious enough.

However, our question 'What is a law of nature?' is of still wider philosophical importance. To see why, we may appeal to Hume. Hume said (*Treatise*, Bk 1, Pt III, Sec. II) that the *only* relation which enables us to infer from observed matters of fact to unobserved matters of fact is the relation of cause and effect. If no such relation existed, we would have no way to reason beyond our observations.

Hume spoke little of laws. Nevertheless, it can be said that he held a law theory of cause and effect. Setting aside the mental component which he found in our concept of cause, he conceived of the relation between cause and effect as a law-like relation. (The law in turn he conceived of as a mere regularity.) We can therefore invoke his authority to say that inferences to particular matters of unobserved fact would not be reliable inferences if there were no laws of nature.

But it is hardly required that we appeal to Hume. The proposition is obvious enough in itself. The scientist trying to establish the geography and history of the unobserved portion of the universe must depend upon what he takes to be the laws of the universe. Otherwise he is helpless. (It is true also, of course, that what he takes the laws to be will in part depend upon what he takes the history and geography to be.) In ordinary life, by contrast, when making inferences to particular matters of unobserved fact, we make little appeal to, and would be unable to state, the supposed laws which ground our inferences. But it is still the case that, on the supposition that there are no laws, the inferences would not be rational.

As Hume understood and emphasized, inference from the observed to the unobserved is central to our whole life as human beings. We have just seen, however, that if there were no laws (whatever a law is, be it regularity or something else), then such inferences would not be reliable. Hence the notion of law is, or should be, a central concept for epistemology. If so, we will also want to enquire into its ontology. We will want to know what a law of nature *is*.

There is one truly eccentric view, brought to my attention by Peter Forrest, which would evade this argument. This is the view that, although

there are regularities in the world, there are no laws of nature. Such a view agrees with critics of the Regularity theory of law that mere regularities are insufficient for law. But, in Eliminativist spirit, it goes on to deny that the world contains anything except these regularities. This Disappearance view of law can nevertheless maintain that inferences to the unobserved are reliable, because, although the world is not law-governed, it is, by luck or for some other reason, regular.

Such a view, however, will have to face the question what good reason we can have to think that the world is regular. It will have to face the Problem of Induction. It will be argued in Chapter 4, Section 5, that no Regularity theorist, whether or not he is prepared to call his regularities 'laws', can escape inductive scepticism.

2 A possible difficulty in investigating our topic

So much by way of apologia for our topic. But it may seem to be somewhat recalcitrant to philosophical investigation. Here we may recall Socrates' and G. E. Moore's 'Paradox of Analysis'. If we ask what sort of thing an X is (a right act, a law of nature. . .) then either we know what an X is, or we do not. If we know, then there is no need to ask the question. If we do not know, then there is no way to begin the investigation. The enquiry is either pointless or impossible.

The orthodox, and I think correct, solution of this puzzle is that we do not start with blank ignorance of what an X is. Instead, we start with an unreflective, unselfconscious or merely practical grasp of the thing. The philosophical object is to pass from this to an articulate, explicit and reasoned grasp of what an X is. We do not go from black night to daylight, but from twilight to daylight.

In such investigations it is a great advantage, to say the least, if we can securely identify instances of X. Given such *paradigms*, we can to some extent tie the enquiry down. An account of what it is to be an X is suggested by a philosopher. If we can be sure that *a* is an X, then we can use other things which we know or believe about *a* to check the proposed account of X. But without paradigms the whole business of testing the proposal becomes very much more difficult.

Our problem is now before us. There are no secure paradigms of laws of nature. Consider contemporary natural science. It is perfectly possible, epistemically possible, that we do not know a single law of nature. This, it may be objected, is a considerable handicap to answering the philosophical question 'What is a law of nature?'

To this objection, two answers may be made.

First, even though we can point to no secure paradigms of laws, the scientific theories which we now work with are obviously a reasonable approximation to at least some of the real laws of nature. For if our theories did not nearly grasp the truth at many points, it would be inexplicable that they should permit so much successful prediction. Theoretical calculations which can return men from the moon with split-second accuracy can hardly be mere fantasies. We may make an ‘inference to the best explanation’ from the predictive success of contemporary scientific theory to the conclusion that such theory mirrors at least some of the laws of nature over some part of their range with tolerable accuracy.

Actually, it seems that even the rough-and-ready generalizations of pre-scientific practical wisdom represent a reasonable degree of approximation to genuine laws. Consider Hume’s examples: fire burns, bread nourishes, water suffocates. If there were not laws to which these generalizations represent some rough approximation, then we should all be dead.

It may be remarked in passing that this first reply to the objection from the absence of paradigms indicates the importance, in the fight against scepticism, of developing a satisfactory theory of degrees of closeness to the truth, a theory of partial truth.

The second answer to the objection is that, even if we know no laws, we do know the *forms* which statements of law take. Consider the following formulae which use dummies:

- (1) It is a law that Fs are Gs
- (2) It is a law that an F has a certain probability ($> 0, < 1$) of being a G
- (3) It is a law that the quantities P and Q co-vary in such a way that Q is a certain function of P ($Q = f(P)$).

It turns out, as a matter of fact, that the sort of fundamental investigation which we are undertaking can largely proceed with mere schemata of this sort. After all, it is not as if philosophers can expect to make any serious contribution to the *scientific* project of establishing what in fact the laws of nature are! Our abstract formulae may actually exhibit the heart of many philosophical problems about laws of nature, disentangled from confusing empirical detail. To every subject, its appropriate level of abstraction.

If more concrete examples are required, then we can take them from current or earlier science. We now know that Newton’s Law of Universal Gravitation is not really a law. Yet we also know that Newton’s formula approximates to the truth for at least a wide range of phenomena. Its

predictive power would be inexplicable otherwise. So it makes a very good stand-in for a paradigm of a law of nature.

In this essay the abstract formula considered will often be (1): It is a law that Fs are Gs. In fact, arguing from the present state of science, it does not seem very likely that many laws are of this form. It would appear, for instance, that the laws governing sub-atomic phenomena are both irreducibly probabilistic and are functional. They have a form which combines (2) and (3).¹ But the peculiar simplicity of (1) makes it extremely useful for discussing a number of difficult philosophical issues concerning laws. These issues would emerge less clearly in more complex contexts.

3 Assumptions

Some of the presuppositions of this enquiry have already emerged. In this section I will mention three further assumptions that I will make. I hope that they will not remain assumptions merely, but that some considerations in their favour will emerge in the course of the discussion. But since they are rather fundamental, and so not easily argued for, and since they are also somewhat controversial, it seems desirable to put them explicitly before the reader.

First, I assume the truth of a Realistic account of laws of nature. That is to say, I assume that they exist independently of the minds which attempt to grasp them. (Just what sort of thing they are, it is the task of this essay to investigate. It is clear, simply from considering the typical forms of law-statements, that a law is some sort of *complex* entity.) Laws of nature must therefore be sharply distinguished from law-statements. Law-statements may be true or (much more likely) false. If they are true, then what makes them true is a law.

The task of the critic of anti-Realist views of laws has been greatly eased by the recent publication of a fine and scholarly article by Alan Musgrave (1981). What he offers is primarily a critique of Wittgensteinian Instrumentalism about laws, as it is found in the *Tractatus*, and in Wittgenstein's followers W. H. Watson, Toulmin, Hanson and Harré. But there is also useful criticism of other anti-Realist positions.

In any case, however, behind all anti-Realist views of laws stands the Regularity theory. After all, those who do not take a Realistic view of laws have to allow that there is *some* foundation in the world for the

1 It may be argued that both (2) and (3) can be reduced to form (1). My reasons for rejecting both these reductions will emerge. See Ch. 3, Sec. 4 for (2) and Ch. 7 for (3).

acceptability or otherwise of law-statements. At this point they must appeal to regularities. Regularities are the Realistic component of anti-Realist theories of laws. As a result, a destructive critique of the Regularity theory, the business of the first Part of this essay, will simultaneously undermine anti-Realist theories of laws.

Second, to this Realism about laws, I add a more specific Realism: Realism about universals. As a matter of fact, I do not think that even the Regularity view can be coherently developed, at least in a Realistic way, without the introduction of universals (Ch. 2, Sec. 4). But, as we shall see (Ch. 6, Sec. 1), the Realist about laws who wishes to go beyond the Regularity theory must certainly invoke universals.

Theories of universals are developed in different ways, and these differences place different constraints upon theories of laws of nature which involve universals. My own Realism about universals is developed in a previous book, *Universals and Scientific Realism* (1978). No acquaintance with that work is presupposed, but in this essay I will state my views about universals (Ch. 6, Sec. 2), and take these views as constraints on my theory of laws. *Arguments* for these views are to be found only in the earlier work. To that extent, this monograph is a sequel to the book on universals. That book's last chapter put forward what now seems to me to be a somewhat primitive form of the view of laws of nature defended in the present work.

Third, in this essay I assume the truth of what may be called Actualism. According to this view, we should not postulate any particulars except actual particulars, nor any properties and relations (universals) save actual, or categorical, properties and relations. I do not think that this should debar us from thinking that both the past and the future exist, or are real. But it does debar us from admitting into our ontology the merely possible, not only the merely logically possible but also the merely physically possible.

This debars us from postulating such properties as dispositions and powers where these are conceived of as properties over and above the categorical properties of objects. It is not denied that statements attributing dispositions and/or powers to objects, or sorts of objects, are often true. But the truth-makers or ontological ground for such true statements must always be found in the actual, or categorical, properties of the objects involved.

I regard Actualism as the most difficult and uncertain of my three assumptions. It is bound up with the difficult question whether the laws of nature involve logical necessities in things: whether there is *de re* logical

necessity involved in laws. For dispositions and powers, if they are conceived of as the non-Actualist conceives them, involve logical or quasi-logical connections in the world between the dispositions and powers, on the one hand, and their actualizations on the other.

4 The Regularity theory

It is convenient to begin by examining and criticizing the Regularity analysis of laws of nature. The credit of this theory does not stand as high as it used to. But, although somewhat battered, it is still orthodoxy among analytic philosophers. In particular, there are still many who would *like* it to be true. While this liking persists, we can expect it to have a powerful, if not always acknowledged, influence. So it is still important to work through the theory in detail, and see just how unsatisfactory it is.

Nor will the value of a discussion of the Regularity theory be critical and therapeutic only. In the course of the criticisms a number of considerations will be introduced which will lead us toward a more satisfactory account of laws of nature, if only by showing us what a good theory of laws ought to do.

With the Regularity theory disposed of, it will then be argued that any satisfactory account of laws of nature must involve universals, and irreducible relations between them. This opens up a new, by no means easy, but exciting programme of philosophical research. The second part of this essay attempts to advance the programme.

Critique of the Regularity theory (1): The problem of accidental uniformities



Laws of nature characteristically *manifest* themselves or *issue* in regularities. It is natural, therefore, in Ockhamist spirit, to consider whether laws are anything more than these manifestations.

When philosophers hear the phrase 'Regularity theory' they are inclined almost automatically to think of a Regularity theory of *causation*. It is important, therefore, to be clear at the outset that what is being considered here is a Regularity theory of *laws*.

The Regularity theory of causation appears to be a conjunction of two propositions: (1) that causal connection is a species of law-like connection; (2) that laws are nothing but regularities in the behaviour of things. It is possible to deny the truth of (1), as Singularist theories of causation do, and then go on either to assert or to deny the truth of (2). Alternatively, (1) can be upheld, and either (2) asserted (yielding the Regularity theory of causation), or (2) denied. The reduction of cause to law, and the reduction of law to regularity, are two independent doctrines. They can be accepted or rejected independently.

It therefore appears that the Regularity theory of causation entails the Regularity theory of laws of nature, because the latter theory is a proper part of the former. By the same token, the Regularity theory of laws of nature fails to entail the Regularity theory of causation. Our concern is with the Regularity theory of law.

1 The Naive Regularity theory of law

There are different versions of the Regularity theory. Effective criticisms of one version may fail to be effective criticisms of another, leading to a certain amount of confusion. George Molnar (1969) provides us with a good strategy in this situation. He begins by outlining a theory which he calls the Regularity theory of laws of nature, but which I shall call the *Naive Regularity* theory. He then considers an important argument against such a theory advanced by William Kneale, an argument from unrealized

physical possibilities. Molnar claims that Kneale's argument succeeds against the theory which he, Molnar, has outlined. However, numerous modifications of this theory can be proposed, with the object of meeting Kneale's and other criticisms. Molnar therefore goes on to consider whether the theory can be rescued from Kneale's attack by means of judicious modifications which still respect the spirit of the theory. He argues, however, that when these proposed modifications are scrutinized, none are found to be satisfactory. He concludes that there is no acceptable form of the Regularity theory. It cannot be modified, it must be abandoned.

I propose to generalize Molnar's strategy. I agree with his estimation of the force of Kneale's argument. But I think that there are many other arguments which either refute, or tell heavily against, the Regularity theory. It is very convenient to advance these as arguments against the Naive theory in the first place, and only after that to consider whether they can be evaded by more sophisticated versions of the theory.

Molnar defines the Naive Regularity theory by using the device of semantic ascent. He says:

p is a *statement* of a law of nature if and only if:

- (i) *p* is universally quantified
- (ii) *p* is [omnitemporally and omnispatially]¹ true
- (iii) *p* is contingent
- (iv) *p* contains only non-local empirical predicates, apart from logical connectives and quantifiers.

There is much in this definition which could be discussed, but which I pass over for the present. I think it will serve our current purposes. It is easy to see the aim of the definition: to pick out the *unrestricted* or *cosmic* uniformities from all other uniformities in nature. I will call them *Humean* uniformities, for obvious reasons. These Humean uniformities the Naive Regularity theory identifies with the laws of nature.

2 Classification of criticisms of the Regularity theory

If we take the Humean uniformities and try to identify them with the laws of nature, then various difficulties for the identification arise. First, there are what may be broadly termed extensional difficulties. There are, or

1 David Lewis has pointed out to me that the bracketed phrase is redundant.