AN ESSENTIALIST PERSPECTIVE ON THE PROBLEM OF INDUCTION

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ABSTRACT

If one believes, as Hume did, that all events are loose and separate, then the problem of induction is probably insoluble Anything could happen But if one thinks, as scientific essentialists do, that the laws of nature are immanent in the world, and depend on the essential natures of things, then there are strong constraints on what could possibly happen Given these constraints, the problem of induction may be soluble For these constraints greatly strengthen the case for conceptual and theoretical conservatism, and rule out Goodmanesque inferences based on alternative descriptions of the world This may not, in itself, solve the problem, but it significantly changes its nature

1. Introduction

Hume's problem of induction is one which arises from his theory of the nature of reality It is not, however, one which can be solved within his metaphysical framework For Hume's world is one of passive objects which, though they may in fact always behave regularly, might well behave irregularly, or in radically different ways Consequently, the laws of nature, which purport to describe the regular patterns of behaviour actually occurring in the world, must be contingent, and there is nothing in Hume's

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world to guarantee the continuation of the regularities we observe, or their extensions into areas we have not observed

The identities of things in Hume's world are independent of what they are disposed to do, i e of their causal powers, capacities and propensities The dispositions of things are supposed to depend on the laws of nature, which might be different in different worlds Thus, things which are constituted very differently might be disposed to behave in exactly the same way, if the laws of nature were sufficiently different (cf the Catholic doctrine of transubstantiation), while things which have precisely the same constitutions might not, or might not always, be disposed to behave in the same ways in the same circumstances In Hume's philosophy, the ways in which things are disposed to behave are supposed to depend, not on their intrinsic natures or constitutions, but on what the laws of nature happen to be Therefore, for a neo-Humean, there is no solution to Hume's problem to be found by considering what sorts of things exist in the world

Nor is Hume's problem solvable within a Cartesian, Lockean, Newtonian, Berkeleyan or Kantian theory of reality For on all of these theories the world is essentially passive, and the ways in which things are disposed to interact are contingent upon the laws of nature Things, as they are in themselves, are supposed to have no genuine causal powers If they appear to be causally active or interactive, then this is not due to any powers which they may have by nature, or which they may have acquired, but to how they are required to behave by the laws which govern them Metaphysically, things in the world are to be thought of as puppets which are pushed around by the forces of God or nature They are not themselves actors on the stage

Induction is therefore a problem for the broad philosophical tradition which has its roots in Seventeenth and Eighteenth mechanism It is not just a problem of empiricism It is a problem for anyone who believes that the laws of nature are superimposed on a world which is essentially passive, and that these laws are contingent, and not knowable *a priori*

To solve the problem of induction, it may be necessary to break with this whole way of looking at things What may be required is a conception of reality which denies that nature is essentially passive, or one which accepts that events may be necessarily connected For Hume's thesis that all events are 'loose and separate', and consequently that there are no necessary connections between events, is an ontological claim which, if true, would seem to make the problem of induction insoluble

Of course, a solution to the problem of induction must ultimately be epistemological That is, it must vindicate most of our ordinary scientific inductive practices But how we ought to reason about the world might well depend on what kind of world we think it is For this will affect what we think the epistemic task is If we think the world is a Humean kind of world, i e a world of disconnected events, then maybe no inductive strategies can be vindicated If so, then perhaps this is sufficient reason to believe that it is not, after all, a Humean kind of world If, however, we think it is a highly structured, and necessarily connected, world of natural kinds of objects, properties and processes, as scientific essentialists do, then our aim must be to discover its nature and structure And this is a very different task from that which confronts the Humean

The aim of this paper is to argue that the problem of induction looks very different from the perspective of a scientific essentialist From this perspective, all scientific

inference is seen as depending ultimately, not just on observed regularities, but on what postulates about natural kinds are justifiable The role of postulates about natural kinds in scientific reasoning has been stressed by a number of writers in recent years (Butts 1977, Forster 1988, Macnamara 1991) Most recently, the point has been made by Howard Sankey in his 'Induction and Natural Kinds' (1997), and by Hilary Kornblith in his *Inductive Inference and its Natural Ground* (1993) Kornblith and Sankey argue that the world has a basic natural kinds structure, and that this is important, because it gives substance to the idea that nature is uniform Specifically, it guarantees that certain properties are uniquely clustered This is true, and important, but I think that a great deal more has to be said about the natural kinds structure of the world, if we are to have a full appreciation of its role

The structure I envisage is much more comprehensive First, it includes hierarchies of natural kinds of properties and processes, as well as the usual hierarchy of natural kinds of objects Hence, I would extend the range of phenomena accessible to natural kind reasoning in new ways Secondly, I would postulate that the natural kinds of properties include all of the physical quantities which are characteristic of things, as they are in themselves, and so, presumably, may be amongst the essential properties of these things, qua members of natural kinds Thirdly, I assume that the essential properties of natural kinds include many that are dispositional, that is, properties which determine how, or define the objective probabilities with which, things of these various kinds would be disposed to act, and react, in various kinds of circumstances Fourthly, I assume that the natural kinds of processes that we call 'causal processes' are just the displays of the intrinsic causal powers, capacities and propensities of the things involved

in them, and consequently, that these processes are grounded in these properties The laws of nature which describe the natural kinds of processes which can occur are thus grounded in the intrinsic, dispositional properties of things

Some of what I have to say in this paper derives from an earlier paper of mine 'A Vindication of Scientific Inductive Practices' (1965), in which I argued for the virtue of conceptual and theoretical conservatism in inductive reasoning I appealed to such considerations specifically to deal with Goodmanesque problems arising from the possibility of radical reconceptualisations of the world (Goodman, 1955) I argued there that there were very good pragmatic reasons for these forms of epistemic conservatism Specifically, I argued (1) that theoretical involvement is a necessary condition for the possibility of rational non-demonstrative argument, and (2) that Goodmanesque conceptual revisions in a given field could easily destroy the theoretical involvement of the terms we use to describe the things that exist in this field Therefore, to make such revisions unnecessarily is irrational, because it must leave us powerless to argue inductively in the area of these revisions

However, I had no wish disallow conceptual or theoretical revision altogether I could only insist that it be thorough, and *prima facie* compatible with any other theories we might have about the kinds of things we think we are dealing with But then, I had to allow that the construction of radical alternative theoretical frameworks might not be all that difficult, especially if there were no constraints other than empirical ones on the kinds of theories that could be developed The supposed virtues of epistemic conservatism could thus quickly lose their appeal Theoretical involvement may be a necessary condition for

the possibility of rational non-demonstrative argument But perhaps Goodmanesque theories could easily be developed to replace the standard ones, and hence serve as a basis for Goodmanesque inferences

I now think that I can advance the argument for theoretical and conceptual conservatism a step or two further For, if the laws of nature are not imposed upon the world, but arise from the essential natures of things in the world, then it is metaphysically impossible for things to behave in any of the bizarre ways envisaged by Goodman in his examples For the essential nature of a thing cannot be dependent on anything that is contingent, such as the date or place of its existence, or whether or not, or how often, it has been observed Consequently, the laws of nature, which derive from the dispositional properties which things have essentially, cannot contain any references to any such contingencies Therefore, it makes a great deal of difference whether one thinks of the laws of nature as impositions on a passive world, or as arising out of its nature If they are imposed on a passive world, then anything goes But if they derive from the essential properties of things, then they cannot be dependent on the specific circumstances of their existence

2. Scientific Essentialism

According to scientific essentialism, the laws of nature are not contingent, but metaphysically necessary, and they are not superimposed on the world, but immanent in it To discover what the laws of nature are, the scientific essentialist holds that we must investigate nature empirically to find out what kinds of things exist, and what properties they have Scientific essentialism thus focusses our attention upon natural kinds and properties, and how we can know about such things

The main tenets of scientific essentialism that are relevant here are

1 The most fundamental things, properties and processes existing in the world all belong to natural kinds That is, there are natural kinds of events or processes (dynamic kinds), natural kinds of properties or relations (property kinds), and natural kinds of objects or substances (substantive kinds)
2 The natural kinds in each category occur in hierarchies The most general kinds are category-wide, and permit a wide range of intrinsic variation amongst their instances The most specific kinds, however, have instances which are all intrinsically identical
3 Substantive things are not passive, but essentially active and interactive That is, the properties in virtue of which things belong to substantive natural kinds always include some which are dispositional, i e some which are causal powers, capacities or propensities
4 The elementary causal processes in which real dispositional properties are displayed all belong to natural kinds The causal laws of nature describe these kinds of processes, and hence the ways in which things are necessarily disposed by their properties to act or interact
5 The laws of nature are therefore not contingent, but metaphysically necessary Anything which has a real dispositional property is necessarily disposed to display it in appropriate triggering circumstances
6 The real dispositional properties of things are properties in their own right They are not ontologically dependent on non-dispositional properties or contingent laws of nature

If scientific essentialism provides us with a true picture of reality, then it gives substance to the idea that na-

ture is uniform, as Sankey suggests For scientific essentialism postulates a highly structured world consisting of hierarchies of natural kinds of objects, properties and processes — all things which, one way or another, are involved as truthmakers for the laws of nature So the task of inquiry, according to an essentialist, is to discover what kinds of objects, properties and processes exist, and what their essential properties are And once we know this, we shall also know what the laws of nature are Scientific essentialism thus provides us with a much more specific agenda for scientific inquiry than any that is provided by the bald claim that nature is uniform Without a great deal of elaboration, the thesis that nature is uniform tells us very little As it stands, it would be too indeterminate to be much use, even if the laws of nature were just regularities in the behaviour of things, as the Humeans believe What would also be needed is an account of uniformity, and a justification for accepting this account rather than any other But such an account and justification are notoriously difficult to provide

Scientific essentialism implies that to accept the traditional Humean view that the dispositional properties of things depend on the laws of nature is to get the relationship of ontological dependence between dispositional properties and laws of nature the wrong way around For the laws of nature, according to scientific essentialism, are not regularities imposed on a passive and obedient nature, but derive from the intrinsic dispositional properties and constitutions of the things that go to make up the world In other words, the laws of nature are immanent in things, they are not the principles according to which they are regulated

However, to defend scientific essentialism adequately, it would be necessary to elaborate a theory of real

properties, especially of real dispositional and intrinsic properties, an ontology of natural kinds, a theory of laws of nature, and to answer the obvious objections to the claim that the laws of nature are metaphysically necessary But this is a task well beyond the scope of the present paper Here I must ask you just to put aside your objections to the overall programme of scientific essentialism, and focus on the question of how one should reason about a non-Humean world which is just as the scientific essentialist believes the actual world to be

3. Properties, Processes and Laws of Nature

Most properties of scientific interest, such as the atomic weight of a chlorine atom, or the charge on an electron, or the p/h of a standard solution, are quantitative That is, they are ultimately specific, or infimic, species of quantities, such as mass, charge or p/h These quantities are natural property kinds, and quantitative properties, like those listed, are amongst the quantitatively specific species of these kinds The most specific species of a given quantity are, of course, to be distinguished from its instances The infimic species of a quantity are its precise values But two or more different things could have the same quantity to the same precise degree So a precise value of a given quantity is not an instance of that quantity, unless the quantity itself is a second order universal, as Bigelow and Pargetter (1988) maintain

But Bigelow and Pargetter are wrong For even the most precise value of any quantity may have many instances, and if the property of having this quantity to this precise degree is a universal, as it surely is, then these instances must all be identical Yet the particular objects which have this quantity to this degree clearly need not be

identical A positron and a proton both have unit positive charge, but no proton is identical with any positron Therefore, the instances of a quantitative property are not the *objects* or *substances* which have it, but the *tropes* of that quantitative property *in* those objects It is important therefore to distinguish between the instances of a quantity and its infimic (i e most specific) species The instances of any quantity are its tropes Its infimic species are its precise values

Ontologically, generic properties, including quantities, are more fundamental than any of their species No specific value of any quantity, for example, is necessary for the existence of the quantity itself Thus, mass might exist in a world in which nothing had unit mass But the reverse is certainly not the case Unit mass could not possibly exist in any world in which the generic quantity, mass, did not exist It is to be expected, therefore, that quantities should play a more important role in physical theory than any of their specific values Even a cursory glance at physical theory would seem to confirm that this is so Yet many theorists (e g Armstrong 1997) have made the contrary assumption, viz that the generic properties depend ontologically on their infimic species But this is an unwarranted assumption which confuses the ontological order with the epistemic one It is true that we never observe generic properties directly We observe only the tropes of these properties which are necessarily quite specific in their values But ontologically, it is the generic properties which are fundamental

The most general laws of nature, which apply to whole ontological categories, are undoubtedly the most fundamental The conservation laws, for example, encompass all events and process within their scope For what they say is that *every* event or processes which can occur in

worlds like ours is intrinsically conservative of X, where X is the conserved quantity More specific laws, such as the laws of electromagnetism, are narrower in scope than the conservation laws, and apply only to a more limited range of phenomena For these laws tell us nothing whatever about phenomena which are not electromagnetic in character

The laws that we call 'causal laws' are a species of laws of nature concerned with relations between ordered pairs of natural kinds of events The events of the first (or causal) kind are the triggering events of a causal power, while those of the second (or effectual) kind are the possible displays of this causal power More formally, these ordered pairs of kinds of events are such that the occurrence of any member of the first kind (a cause) will necessitate, or bring about, an occurrence of some member of the second kind (its effect) That is, for every event of the causal kind, which is associated with a given causal power, it is necessary that there should be an event of the effectual kind which will be its display Any statement describing such a necessary connection between natural kinds of events is a *qualitative causal law*

If the events of the two kinds can be described quantitatively (as they usually can be), then to each quantitatively specific species of event of the first, or causal, kind, there will be a probability function ranging over quantitatively specific species of events of second, or effectual, kind The statement of this probability function is a *quantitative causal law* Where we have such a law, a particular event of the causal kind (which will necessarily be quantitatively specific) will, necessarily, make it probable to some precise degree that an instance of a quantitatively specific species of event of the effectual kind will occur

4. The Essentialist's World

Essentialism implies that some events make other events of various kinds more or less probable They rarely necessitate other events of quantitatively specific kinds Consequently, the laws of nature are mostly not deterministic, but probabilistic However, to simplify the picture, in order to get a clearer view of the essentialist's world, let us suppose that the causal laws are all deterministic That is, let us assume that events which belong to any given causal kind always necessitate quantitatively specific kinds of events of the corresponding effectual kind For example, let us assume that a triggering event, *vis a vis* any given causal power, will always necessitate a specific kind of display of this power

Suppose, for example, that P is a natural dispositional property which would be triggered in circumstances of the kind C to produce an effect of the kind E Then the processes of this kind will themselves constitute a natural kind, the essence of which is that it is a display of P Refraction, for example, is a natural kind of process, the essence of which is that it is a display of refractivity One could, perhaps, imitate refraction by some elaborate system of diffraction gratings and mirrors But if it is not a display of the refractivity of some material, then it is not a case of refraction, however like such a display it may be Moreover, nothing could be a display of refractivity if it did not have the characteristics which are essential to such a display, or were not produced by the refraction of light through a refracting medium Therefore,

L1 For all x, necessarily, if x has P, and x is in circumstances of the kind C, then x will display an effect of the kind E

Note that the necessity operator in this formula is *within the scope of the universal quantifier*, i e in *de re* position Moreover, if *a* is an individual which has P necessarily, e g because P is an essential property of *a*, then we may detach and deduce that

> Necessarily, if *a* is in circumstances C, then *a* will display an effect of the kind E

And this, it should be noted, is a necessary connection between events of precisely the kind that Hume rejected

The kind of necessity involved in a causal law such as this is therefore metaphysical necessity This kind of necessity has the strength of logical necessity, but is grounded in nature, rather than in language or thought The same reasoning applies generally to all causal laws For all such laws describe natural kinds of processes which are the displays of causal powers So all causal laws will be necessary truths, i e they will be true in all possible worlds But metaphysical necessities, such as these, are unlike other strong necessities, such as those of language (analytic truths) and thought (logical truths), because they are discoverable only *a posteriori* They are not *a priori* necessary truths, but *a posteriori* necessary truths which can be found only by the empirical methods of science

The essentialist's world is therefore not one in which all events are loose and separate On the contrary, it is a world dominated by causal powers, in which events triggering these powers necessitate other events which are their displays If it were a deterministic world, as I have imagined, then any two things which are intrinsically the same must, of metaphysical necessity, be disposed to behave in the same way, and, indeed, must behave in the same way in the same circumstances Even in an indeter-

ministic world something akin to this is true Two things which are intrinsically the same must, of metaphysical necessity, be intrinsically disposed to behave in the same *kind* of way (with a real probability distribution ranging over the possible expressions of their common intrinsic properties)

The essentialist's world is therefore a bound and connected world If what we take to be the same natural kind of thing recurs, and we do something of the same sort to it, then we should expect it to respond as any member of that kind must respond qua member of that kind Specifically, it should display the essential dispositional properties of things of that kind for which the action we took is a trigger If it does do so, then there is nothing to explain, except, perhaps, how the process works If it does not do so, then the question arises why should this thing be different from other things of its kind? There are many possibilities either (a) the thing does not belong to the natural kind to which it appears to belong (It might, for example, be a different species of the same generic kind), or (b) what we did to it was not an effective trigger (i e did not belong to the appropriate natural kind of triggering events), or (c) we are mistaken about what the essential properties of the kind were, or (d) the expected effect did occur, but was masked by other events, or

So, for an essentialist, the problem of induction has a rather different flavour It is not a question of justifying the inference from 'all observed As are Bs' to 'all As are Bs' This inference would be justified automatically if we had good reason to believe that the As we had observed belonged to a natural kind, and that the property of being a B was an essential property of the As In that case, the problem would be, rather, to explain the failure of such an inference Where we have a case of inductive failure, there are many possible explanations which must be sorted

through, and the scientific task is to do this, eliminate alternatives, and determine which of the remaining alternatives provides the best explanation We might decide that the class designated by 'A' is not a natural kind class, or that there are no essential properties of As in virtue of which they are Bs, so that if an A is a B, then this is just an accident, or that the apparent exceptions are either not really As, or they really are Bs (i e monster -barring and monster-adjustment), or any of a number of other things But whatever we decide, we will have learned something from our experience, and our conceptualisation of the world will have been improved

5. Natural Kinds, Cluster Kinds and Social Constructs

Natural kinds are distinguished from other sorts of things in several ways Specifically, they are objective kinds That is, they are kinds which exist in nature independently of our classificatory systems Their existence does not depend on how think about the world, the language we use, what distinctions we make, or what classes of things we recognise Natural kinds are nevertheless clearly distinct from each other, i e they do not merge one into another, so that an arbitrary distinction would have to be made to separate them The distinctions between natural kinds exist objectively They are there in nature for us to discover, whether or not we recognise them And they cannot be defined into or out of existence Natural kinds are not only distinct from each other, but are distinguished from each other by an indefinite number of intrinsic properties or structures which are severally necessary and jointly sufficient for membership These properties and structures together constitute what is called the *real essence* of the kind,

and things which belong to the kind are said to have these properties essentially

Objects and processes of kinds which satisfy these requirements are the usual objects of study in the physical sciences, and also in parts of biology, microbiology and biochemistry There are, for example, thousands of chemical compounds which satisfy them, and tens of thousands of chemical processes However, the normal objects of study in the social and human sciences are not natural kinds, and the biological distinctions between species are not natural kind distinctions, (in the strict sense in which this term is being used here) Therefore, to the extent that natural kind reasoning differs from reasoning about other kinds of things, the reasoning involved in theory construction in the physical sciences will be different from the reasoning required for theory construction elsewhere It is as well, therefore, to be cautious about drawing inferences from the logic of the physical sciences to apply to the social sciences, and conversely The social and physical sciences have very different kinds of subject matters, and we should not expect their logics to be the same

Biological species are what I call 'cluster kinds' With rare exceptions, (e g clones and identical twins), each member of a biological species is different intrinsically from every other member It has a different genetic make-up Therefore, unless we are prepared to count each member of a biological species (which has no identical twin or clone) as *sui generis*, the species classification is not a strict natural kinds classification For members of the same biological species are not constitutionally identical Moreover, the distinctions between species are not always objective, even if we confine ourselves to considering only living animals and plants If we also wish our classification system to apply to historical animals, as we surely do, then there will be

no objective distinctions between adjacent species Nevertheless, biological species are sufficiently like natural kinds for many of the normal expectations of natural kinds reasoning to be fulfilled The natural instincts, mating habits, growth patterns, digestive systems, bone and muscle structures, etc of any one group of animals of a given species are to be expected to be the same as those of any other group of animals of the same species And, if any such inference fails, then, barring extraordinary explanations, this may be sufficient ground for recognising the existence of subspecies, or varieties, of the species in question

In the social sciences, the kinds we have to deal with are mostly socially constructed, and very few of the objects of investigation satisfy any of the criteria for natural kind-hood Therefore, we must proceed in the social sciences with far weaker assumptions of uniformity than we should in the physical or biological sciences Of course, human beings, as members of a biological species, must be expected to develop similarly, to have more of less similar capacities, to respond to situations in similar ways, to be motivated by the same sorts of considerations, to act similarly, and so on That is, we have a more or less common human nature Consequently, there are normality projections we can make, and explanations we can offer, of human responses to social events which have fairly general validity Social events are therefore not quite as loose and separate as Hume imagined all events to be Nevertheless, the social institutions we construct as humean beings are not natural kinds, and so we must be very careful in generalising about them There are no social forces which have a uniform mode of action across societies, and therefore there are no natural laws of society to be found

6. The Case for Epistemic Conservatism in Inductive Reasoning

In 'A Vindication of Scientific Inductive Practices', I argued that 'theoretical involvement [of the subject matter of our inferences] is a necessary condition for the possibility of rational non-demonstrative argument' (Ellis 1965, p 296) That being the case, I argued, it is necessary either (a) to predict that future observations will conform to accepted theories about the nature of the subject matter, or (b) to recast our theories about the subject matter in ways which are no less acceptable, given past observations, and to predict that future observations will conform to these new theories No other strategy will guarantee the preservation of the kind of theoretical involvement necessary for rational non-demonstrative argument

Without theoretical involvement, I argued, *every* prediction about the future, or unobserved past, can be justified with reference to *any* plausible inductive rule For different ways of conceptualising what is known to have happened lead to substantially different predictions about what will happen, or what must have happened Therefore, if there is no preferred way of conceptualising what has happened, then there is no preferred way of projecting what will happen Anything goes

Therefore, I argued, it is irrational to project any sequence of events into the future, or unobserved past, in such a way that, if the projection were actually to be confirmed, then our theoretical understanding of the subject matter of our inference would be destroyed This is what is wrong with Goodman's 'grue' and 'bleen' projections, for example If green things like emeralds, and blue things like sapphires, really did turn out to be grue and bleen respectively, and this were confirmed, not only by observation,

but photographically and spectrographically, then our theoretical understanding of matter, and of light and colour, would be thrown into turmoil It would leave us in a state of bewilderment, no longer knowing what to expect about the colours of things in future Therefore, to accept such an inference is irrational To do so is to reject our previous theoretical understanding of the subject-matter of the inference, not on the basis of anything that is known to have happened, *but solely on the basis of what is projected will happen* If this were a rational procedure, I argued, then all theories could be rejected out of hand, and then we really would be in the a-theoretical position that Hume imagined us to be

I see no reason to disagree with any of this But, at the time of writing, I had not seen the connection with natural kinds Nor would I have quarreled with Hume's view that anything which is conceivable (or imaginable) is possible So I had no difficulty with the *possibility* of things behaving in irregular, or even bizarre, ways For me, possibility was just epistemic possibility I had no conception of real possibility Consequently, what I thought was possible would have allowed my imagination free reign My constraints on irregular or bizarre projections of observed regularities did not derive from a belief that such projections are not real possibilities It was just that we had no viable alternative to the kind of epistemic conservatism I then advocated It was that or the bush

My residual worry was that 'alternative, but so far equally satisfactory theories' about the subject-matters of our inductive inferences, might turn out to be fairly easy to construct If so, then nothing would have been gained by my argument for epistemic conservatism For a world which is, as far as we know, compatible with many different, but overall coherent, readily constructible, and equally

satisfactory, conceptions of reality, would be a world with too many choices It would be a world with too many signposts If alternative, Goodmanesque, global theories of reality could easily be constructed, then alternative, Goodmanesque, projections of observed regularities could be made without violating any of the requirements of epistemic conservatism

7. The Essentialist's Perspective

From my present scientific essentialist perspective, my earlier worry about the possibility of alternative conceptualisations of reality now appears to be unfounded When I was writing then, I assumed, as nearly everyone else did, that the laws of nature are contingent, and are superimposed on an unsuspecting, and passive, world Consequently, I had no argument against the possibility of there being Goodmanesque laws of nature, and hence Goodmanesque dispositional properties I now think that this is all wrong The laws of nature are not contingent, but necessary, and they are not superimposed on things, but are immanent in them The principal scientific task, according to a scientific essentialist, is to discover what natural kinds of things there are, and what their essential properties and structures are When we know this, we shall know how things are necessarily disposed to behave and interact, and thus what the laws of nature are

The conceptualisation which has resulted from this endeavour is the one in current use Therefore, to reject it is to reject one of the principal achievements of science For there is no alternative conceptualisation which is compatible with these achievements If there were, then we should all have heard about it It is all very well to imagine that we might all be brains in vats, and that our scientific knowledge is consequently illusory, or that, with diligence, we

could redescribe the world that is so far known to us in a Goodmanesque way But the first is a sceptical position which has no bearing on the problem of induction, and the second is an inference drawn from the alleged arbitrariness of linguistic conventions Neither tells us anything about what the world is really like Only our science tells us that Hence, the kind of epistemic conservatism that is required to justify our scientific inductive practices is not a stance which needs any independent justification Epistemic conservatism of the kind required to justify our scientific inductive practices is just the determination to hold on to the achievements of science, including its conceptualisations, until we are forced to make changes to accommodate new information If we are not epistemic conservatives in this sense, then we do not believe in the results of science, and there is nothing for us to justify

From the standpoint of a scientific essentialist, date- or observation-dependent properties like grue and bleen cannot be characteristic of kinds For the date of an occurrence concerning an object of a given kind, say A, depends accidentally on its relationship to those events which serve as reference points for dating purposes Therefore, there cannot be an essential property of As which is date-dependent, i e there cannot be an essential property of As whose mode of operation is a function of the date Therefore, there cannot be a law of nature describing how As are by nature disposed to behave which is date-dependent Therefore, it is impossible, metaphysically impossible, that anything should be, by nature, grue or bleen Such properties simply cannot exist in any world in which the laws of nature depend on the essential properties and structures of natural kinds of things

Scientific essentialism thus imposes very strong limitations on the kinds of conceptual and theoretical innova-

tions that can be made It is one thing to be constrained only by considerations of empirical adequacy, and an ill-defined notion of regularity It is another to be constrained by the requirement that things must always be supposed to behave strictly according to their intrinsic natures

References

Armstrong, D M 1997 *A World of States of Affairs* Cambridge The University Press

Bigelow, J C & Pargetter, R J 1988 "Quantities" *Philosophical Studies* **54** 75–92

Butts, R E 1977 "Consilience of Inductions and the Problem of Conceptual Change in Science" *In* Colodny, R G (ed), *Logic, Laws and Life* Pittsburgh Pittsburgh University Press, pp 71–88

Ellis, B D 1965 "A Vindication of Scientific Inductive Practices" *American Philosophical Quarterly* **2** 296–305

Forster, M R 1988 "Unification, Explanation, and the Composition of Causes in Newtonian Mechanics" *Studies in the History and Philosophy of Science* **19** 55–101

Goodman, N 1955 *Fact, Fiction and Forecast* Cambridge, Mass Harvard University Press

Kornblith, H 1993 *Inductive Inference and its Natural Ground* Cambridge, Mass MIT Press

Macnamara, J 1991 "Understanding Induction" *British Journal for the Philosophy of Science* **42** 21–48

Sankey, H 1997 "Induction and Natural Kinds" *Principia* **1**(2) 235–54

Keywords

Induction, natural kinds, scientific essentialism, Goodman, epistemic conservatism

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