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HUME AND THE PROBLEM OF LOCAL INDUCTION

This paper is an epistemological attempt to outline the problem of local induction relative to the classical framework set forth by Hume. The reconstruction of the latter will be rather unexegetically simplified in the light of the former. Hume's approach to factual knowledge and induction was to a very large extent motivated and influenced by his opposition to, and criticism of, rationalism. I will try to project the problem of local induction against this background. I will claim that, his nuances and sometimes surprising qualifications notwithstanding (particularly in the Appendix to (173)), Hume's approach to knowledge was atheoretical; and that it is this feature, perhaps more than anything else, which shaped his understanding of induction and left a profound mark on subsequent developments in the philosophy of induction. In contrast with it, I will argue that any epistemologically sound treatment of induction should be theoretical, or relative to a theoretical context of knowledge, and that methodologically this favors a relevance approach to local induction.

I. MEDIUM AND REASONING

In his account of induction Hume was primarily concerned with the logical link or connection that, if available, would make induction a perfectly rational or demonstrative kind of inference. He referred to this link or connection as 'medium'. Hume's quest for such a medium was conceptually associated with his quest for the proper demonstrative reasoning underlying inductive inference¹. Together, the medium and the reasoning were supposed to explain, rationalize, and justify induction:

(A) ... It must be acknowledged that there is here a consequence drawn by the mind, that there is a certain step taken, a process of thought, and an inference which wants to be explained. These two propositions are far from being the same: *I have found that such an object has always been attended with such an effect* and *I foresee that other objects*

which are in appearance similar will be attended with similar effects. I shall allow, if you please, that the one proposition may justly be inferred from the other; I know, in fact, that it always is inferred. But if you insist that the inference is made by a chain of reasoning, I desire you to produce that reasoning. The connection between these propositions is not intuitive. There is required a medium which may enable the mind to draw such an inference, if indeed it be drawn by reasoning and argument. What that medium is, I must confess, passes my comprehension; and it is incumbent on those to produce it who assert that it really exists and is the origin of all our conclusions concerning matter of fact (Hume (1748), p. 34).

This is, basically, Hume's *logical* problem of induction in terms of medium and reasoning. (Note in the above quotation the dual role the medium is supposed to play, i.e., logical, enabling the mind to draw an inference, and empirical, being the origin of all our conclusions concerning matter of fact.) As formulated in (A), it seems to be restricted to the empirical knowledge. But Hume was also aware of an ontological dimension of the problem of induction. Acknowledging the traditional distinction between (in his terms) 'secret powers' and 'sensible qualities', Hume thought that the inference from the latter to the former faces the *same* logical problem in terms of medium and reasoning:

- (B) Should it be said that, from a number of uniform experiments, we *infer* a connection between sensible qualities and the secret powers; this, I must confess, seems the same difficulty couched in different terms. The question still recurs, on what process of argument this *inference* is founded? Where is the medium, the interposing ideas, which join propositions so very wide of each other? (*op. cit.*, pp. 36-7)².

Hume then remarks: "Here, then, is our natural state of ignorance with regard to the powers and influence of all objects"; and asks: "How is this remedied by experience?" (*loc. cit.*) The answer should be referred to (A). As we shall see, there is here a circularity which cannot be disposed of on Hume's own grounds. For (A) and (B) face the same difficulty *only* if induction is allowed to depend on causation, and conversely, *and* both induction and causation are accounted for in an atheoretical manner.

Let us note for the moment that in both (A) and (B) the inference involved needs an argumentative justification *via* a demonstrative reasoning.

Many philosophers have observed that Hume's requirement that induction should be demonstratively justified is a nonsense since definitionally it is not supposed to be deduction. It seems to me that Hume's requirement is only a trivial consequence of a deeper one. For Hume's main concern was to find a reasoning that is both demonstrative and factual.

The key to such a reasoning is the notion of medium. It is the medium that can make any inference demonstrative. And the key to the notion of medium is causation. For, as I will try to show in the next section, what Hume seemed to mean by demonstrative and factual reasoning is nowadays captured, to a very large extent, by the notion of causal explanation.

II. CAUSATION

Hume's problem of causation is very closely related to that of induction. For him, factual knowledge is based on causal relations, and the latter are based on inductive inference from experience³. On the other hand, it appears that inductive inference cannot be demonstratively justified because a basic ingredient of causation, i.e. the notion of necessary connection, cannot be empirically established. The only inference able to do it, i.e. induction, was found wanting.

It is important to note that this circularity does not appear in Hume's *own* solution of induction and causation. It is rather an essential aspect built into his critical attempt to demolish rationalism. The notion of causation Hume was attacking was supposed (by most rationalists before him) to operate in an ordered and deterministic universe open to reason or intellect either intuitively, a priori, or demonstratively. For Hume, I believe, *these* notions of causation and reason had to stand or fall together. And he obviously looked for the latter course. In the process, he suggested such (empirically unattainable) standards for inductive inference as to fit the rationalist requirements for both causation and reason, i.e. factual and demonstrative reasoning. These causation-cum-reason standards come very close to our notion of causal explanation. The notion of medium Hume (while granting the rationalist's assumptions) was 'expecting' to play both an ontological and logical role, thus making induction both factual and demonstrative, actually has its place in our scheme of causal explanation. Let me amplify these remarks.

Many of Hume's arguments against rationalism seem to suggest that a positive (i.e. along rationalist lines) solution to the problem of causation would lead to a positive (i.e. logical) solution to the problem of induction.

For Hume's quest for a medium, in a logical sense, was mirroring his quest for a necessary connection between causes and effects, in an ontological sense. In the scheme of causal explanation, what Hume took for 'causes' are 'initial conditions', while his 'effects' are 'predictions' or 'explananda'. On this reading, both 'causes' and 'effects' satisfy the other two requirements for causation, namely (physical) contiguity and (temporal) succession. The only missing link (and third requirement to be satisfied) is the notion of necessary connection or law. The medium *qua* law statement would logically connect the statements about initial conditions and facts to be explained, respectively, thus providing the required demonstrative reasoning applied to matters of fact.

Besides the general plausibility of this construal there are some specific reasons to hold it. For one thing, the scheme of causal explanation can logically handle problems of explanation proper, prediction, and retrodiction, with which Hume was equally concerned when discussing induction. For another, Hume was perfectly aware that, if justifiably established, a medium (*qua* law statement) between causes (*qua* initial conditions) and effects (*qua* explananda or predictanda) will not only allow for a demonstrative reasoning ("by which they become proofs of each other's existence", (1748), p. 76)⁴, but will do so by providing a *sufficient condition* for establishing the conclusion of such a reasoning. And this is exactly what is logically expected from the law statement in a causal explanation. (It is useful to note, in this respect, the multiple role played by the notion of medium if the rationalist account would have worked: as a necessary connection or law, it is an ontologically sufficient reason; as a piece of empirical knowledge, it constitutes sufficient evidence; and finally, as a logical 'middle statement', it provides a sufficient condition. Anticipating again, it was Hume's mistake to assume that these roles should be accounted for in the same way.) Finally, after deciding that empirical knowledge degenerates into probability and that consequently the problems of induction and causation should be treated at this new level, Hume defined probability itself in terms of causation as being "nothing real in itself, and properly speaking, is merely the negation of a cause, its influence on the mind is contrary to that of causation" «1739), p. 125)⁵. Probability, too, appears as a poor substitute for causal certainty.

III. ATHEORETICITY

This is roughly an essential part of the rationalist background from which, and against which, Hume mounted his criticism of induction and causation.

The weakest spot in this background seems to be the notion of necessary connection and its inferential counterpart, the notion of medium. Hume's criticism of 'necessary connection' and arguments against the availability of a corresponding 'medium', as fundamental prerequisites of his own approach to knowledge and induction, are mostly responsible for his ultimate conclusion (and answer to the sequence of questions quoted in Note 3) that: "all inferences from experience ... are effects of custom, not of reasoning" ((1748), p. 43). Motivated by his antirationalistic stance, Hume began and ended with an entirely atheoretical approach to factual knowledge. He granted rationalism a logical approach to the latter, and found it deficient. And rightly so. But then he ended in a purely experiential approach, and mistakenly so. For neither pure logic nor pure experience can alone, or even taken together, account for factual knowledge and induction. Theoretical knowledge is required as a medium.

However, it seems to me that Hume's atheoretical view of induction has strong preinductive roots, which both his criticism of rationalism and his own solutions tended to reinforce. So we have a systematic framework of atheoreticity that I shall briefly examine in the next subsections.

1. Let us begin with a logical source of Hume's atheoretical view of knowledge and induction, namely his notion of resemblance or similarity. Hume's account of factual knowledge rests on three relations: resemblance, contingency, and causation. The former has absolute functional priority⁶. Like many philosophers of induction, Hume failed to see the *relativity* of similarity, and its implications.

Things are similar only in certain respects, in so far as the perception and knowledge of similarity are concerned. A point of view or perspective are required in order to identify those respects in which things are similar and the degree to which they are so. Furthermore, things that are similar from one point of view may be dissimilar from another. Similarity, and by implication repetition and classical induction (if any), do presuppose a certain point of view or perspective. In other words, induction is perspective-dependent because, antecedently, so is similarity? The very notion of the uniformity of nature, on which the philosophy of induction rests so heavily, is also relative and perspective-dependent. For one can justifiably ask: in what respects, and relative to what point of view or theory, is nature uniform? And in what respects is the uniformity itself looked at? Is it constancy, or continuity, or lawful evolution, or what? To speak of a neutral, perspective-free uniformity of nature is a very uninformative and entropic way of conceiving of, and looking at, nature.

But neither similarity nor uniformity of nature is perspective-dependent just because we happen to entertain some point of view. A certain problem, area of interest, or cognitive concern are also required in order to direct our intellectual curiosity toward *certain* (classes of) things, and to actuate the relevant criteria of similarity. In theoretically organized knowledge, the resulting process will very often be an inquiry. (We already have here the basic ingredients of local induction *qua* inquiry-oriented and theory-dependent induction. As such, however, it is no longer the notion of induction Hume dealt with. But the important modification involved here stems, I think, from a direct criticism of Hume's atheoretical view.)

Similarity is not only relative in the above sense. It also has a conceptual solidarity with the notion of kind, and by implication with that of *classification* or conceptual scheme (see Quine (1969)). No matter how we will eventually account for the source of primary classifications {as 'inborn expectations' (Popper) or 'prior spacing of qualities' (Quine) or results of actions (Piaget)}, and their conceptual relationships to the most sophisticated scientific taxonomies, it seems plausible to hold that both natural and scientific induction operate relative to prior standards of similarity built into, or directly traceable to, relevant classifications. In any mature science, the basic parameters of such classifications will belong to the network of theoretical entities and laws governing their behavior and connections.

His theory of instinct and propensities of mind notwithstanding, Hume saw no natural basis for relative similarity and perspective-dependent knowledge. Nor did he allow any theoretical basis, such as hypothetical or conjectural thinking, for positing classifications:

Every link in the chain [of argument of causes and effects] would ... hang upon another; but there would not be any thing fixed to one end of it, capable of sustaining the whole; and consequently there would be no belief nor evidence. And this actually is the case with all *hypothetical* arguments, or reasonings upon a supposition; there being in them, neither any present impression, nor belief of a real existence (Hume (1739), p. 83).

We note here another important source of Hume's atheoretical view of knowledge and induction, namely his copy theory of (passive) mind with its two basic components, pertaining to impressions and ideas, and causal stimulation of knowledge, respectively.

2. Let us begin with Hume's theory of impressions and ideas. For our purpose, it can be summarized in two sentences: "All ideas are derived from, and represent, impressions", and " ... reason alone can never give rise to any original idea" ((1739), pp. 161, and 157, respectively). It follows that hypothetical thinking or theorizing has no perceptual counterpart and is empirically unjustifiable. No idea transcending available impressions can have ontological import. Nor are impressions themselves a reliable guide beyond their own coherence:

... Our impressions are causes of our ideas ... [But] as to those *impressions*, which arise from the *senses*, their ultimate cause is, in my opinion, perfectly inexplicable by human reason, and it will always be impossible to decide with certainty, whether they arise immediately from the object, or are produced by the creative power of the mind, or are derived from the author of our being. Nor is such a question any way material to our present purpose. We may draw inferences from the coherence of our perceptions, whether they be true or false; whether they represent nature justly, or be mere illusions of the senses (Hume (1739), pp. 5, and 84, respectively).

This is a most remarkable admission of what, in my opinion, Hume's epistemology stands for: namely, a coordinated retreat from both ontology and theoretical knowledge. There is here a cognitive causal impasse that mirrors that in which, as shown above, induction and causation were inextricably caught. In other words, there is a strong parallel between Hume's initial projection of causal explanation as (according to rationalism) a structural ideal of factual knowledge, whose empirical elusiveness shaped his final construal of causation and induction, on the one hand, and his causal account of cognition itself, on the other hand. The latter will also face the same problem as the former. A medium and a reasoning are required to inferentially connect ideas to impressions, and impressions to senses, and senses to their sources of causal stimulation, whatever these may be. If, at the structural level, the sciences of nature were found causally and inductively imperfect, so were at a cognitive or even psychological level the sciences of man. And let us remember that it was Hume's aim to base the former on the latter. No wonder that the coherence of our perceptions provides the final arbitration since both structurally, and cognitively, we face, according to Hume, the same insoluble problems of induction and causation. (This is a most unfortunate confusion that does not allow for the

distinction between what knowledge is ontologically about; what is evidence for such knowledge; and the cognitive processes themselves.)

An important motivation of the above parallel lies in what Hume's causal account of cognition and atheoretical approach to knowledge rely on: i.e. the *passivity* of human knowledge. There is no relative similarity because knowledge has no essentially active powers of discrimination. There is no idea unless there is a sensory stimulation. In general, in order to function both psychologically and theoretically this knowledge has to be constantly stimulated or caused in a chain-like manner, and justified by causally previous, and eventually external, sources. In other words, the resulting foundationalism has to account causally-cum-externally for almost each cognitive move, to look for the impression corresponding to an idea, and for its cause, and for the cause of this cause, and so on (see Hume (1739), pp. 82-84). In order to be justified (again with respect to both knowledge claims, evidence for them, and underlying cognitive processes) such an account will need a medium and a demonstrative reasoning connecting the source or cause (whatever its place in the chain) and the result or effect, as well as a principle of uniformity of nature as a 'supermedium' for all possible connections. And these too should be accounted and justified in the same way. The structure of justification, expected to take over what a passive knowledge cannot initiate and accomplish, breaks down under an insuperable logical pressure.

3. Another important stronghold of Hume's atheoretical epistemology, related to the previous ones, is his notion of necessity. At one point Hume was writing: "Perhaps it will appear in the end that the necessary connection depends on the inference, instead of the inference's depending on the necessary connection" (1739), p. 88). Actually, due to the circularity in which (when projected against the rationalist background) causation and induction are involved, Hume had it both ways. On the one hand, according to his copy theory of mind and causal account of cognition, the idea of necessary connection has no sensory counterpart and therefore no experiential import. But it also has no traceable cause and therefore no ontological import. Hence, according to our previous analysis of causal explanation, there is no medium and no demonstrative reasoning. On the other hand, there is no inference capable of establishing the idea of necessary connection unless it can be demonstratively justified - and it cannot. Perhaps Hume should have rather said that in the end it will appear that the idea of necessary connection depends on the idea of necessary connection!

But such a result follows not only from inferential, evidential, and cognitive failures. It also follows from a self-defeating definition of necessity, as far as factual knowledge is concerned. For it was, I think, in the spirit of Hume's antirationalistic strategy to load the concept of demonstrative reasoning and of causation-based-on-necessary connection with the *same* notion of necessity, and to oppose it to both *his* weaker concepts of induction and causation-based-on-constant-conjunction. Let us consider the following fragment:

... No inference from cause to effect amounts to a demonstration. Of which there is this evident proof. The mind can always *conceive* any effect to follow from any cause, and indeed any event to follow upon another; whatever we *conceive* is possible, at least in a metaphysical sense; but wherever a demonstration takes place the contrary is impossible and implies a contradiction. There is no demonstration, therefore, for any conjunction of cause and effect (Hume (1740), p. 188).

What Hume had here in mind is logical necessity and logical conceivability. One can logically conceive any event following from any other event (because they are logically independent) but he cannot do so *theoretically*. And this makes all the difference in the world of knowledge. Causation is relative to theoretical, not logical, conceivability; and so is the idea of necessary connection. Hume was oftentimes praised for having proved that the future is logically independent of the past and that effects are logically independent of causes. I think that this is a most trivial result unless one is expecting to find logical necessity and dependence in nature. If one entertains such an expectation, then Hume's arguments are most convincing. But for one who does not, it is not surprising that Hume could not find any logically necessary connection in nature, nor any impression of it in experience; just as it is not surprising that no inference from experience can establish such a connection.

The conceptual status of Hume's notion of medium is now more clear. We have first assumed with Hume that the notion of logical medium has an ontological and empirical counterpart, and that the latter, if available, would solve the problem of causation and induction. Then Hume showed that they are not available either inferentially or cognitively. Therefore there is no medium imposing logical restrictions on causal relations. As a result: "the mind can always *conceive* any effect to follow from any cause". Now take the latter claim as the basic premise or assumption of the whole edifice

and look back: the inevitable conclusion would be that Hume was after the wrong target from the very beginning. This was the point of the previous paragraph. On either reading, however, there is an invariant mistake: i.e. the atheoretical approach to factual knowledge. For neither pure logic nor pure experience can account for the latter; and neither can deliver the genuine medium of factual knowledge: the ontological claims made by a scientific theory.

Let us note Hume's similar approach to the notion of the uniformity of nature:

... there can be no *demonstrative* arguments to prove *that those instances, of which we have had no experience, resemble those, of which we have had experience*. We can at least conceive a change in the course of nature; which sufficiently prove that such a change is not absolutely impossible ((1739), p. 89).

And again, I will claim, a 'change in the course of nature' is a question of theoretical, not of logical, conceivability, just as causation is. In either case, logical conceivability is irrelevant, and therefore cannot adequately be used as an argument against induction.

The problem of induction is not logical but theoretical, or relative to a theoretical context. Experience does not face logical reason, and its powers of conceivability, but theoretical reason. It is the latter, not the former, which can provide the genuine medium Hume was looking for. We have to go beyond Hume's way of thinking to find it. And going beyond Hume means in this context reinstating theoretical knowledge as the proper frame of reference for induction. It is relative to this frame of reference that the problem of local induction acquires its legitimate status.

IV. THE PROBLEM OF LOCAL INDUCTION

If my criticism of Hume's reconstruction of the problem of induction is valid, then there are important consequences that can provide an alternative reconstruction as a possible framework for local induction.

In this concluding section I will explore some of these consequences, and take them as a basis for understanding local induction.

1. If induction is made relative to a theory, and *its* evidential environment, we are conceptually able to use the well-known distinction between the ontological *claim* made by a theoretical statement and the *evidence* relevant to it (see Hempel (1965), pp. 350-351, and 379). Against the Humean framework, this distinction allows for the separation of induction from causation, necessary connection, and uniformity of nature - and in general from any ontological function directly attributed to, or expected from, induction.

According to this distinction, the statement of a causal law makes an ontological claim within a certain theory. Individual and empirically unique events will count as instances, and hence as relevant evidence, only in virtue of such claims. More often than not, it is the claim that directs our quest for such instances, which imputes similarity to them, and finds them empirically relevant and informative. Furthermore, the statement of a causal law refers to a *physically* necessary connection claimed to hold between certain kinds or classes of entities to which a certain theory is preinductively committed. The same applies to any nomological law, in general, or to a statistical law. What may change is the form of the ontological claim, reflecting new theoretical classifications and new physical connections between, or dispositions of, the entities considered. On the other hand, we may consider empirical generalizations or laws for which, relative to a determinate theory, there are both instantial relevant evidence (as above) and theoretical evidence in the form of higher level (or theoretical) laws. There is no Humean induction involved here since the instantial empirical evidence is a function of claim and theory, whereas the theoretical evidence is usually introduced as a more general premise.

The notion of uniformity of nature can itself be freed from its experiential connotations and its inductive functions, and regarded as an ontological claim *sui generis* made by a certain theory. Although it does not seem to be the exclusive or primary object of study of most scientific theories, many of the latter have built-in clauses and laws to this effect⁸. It is, however, plausible to assume that in various ontological respects uniformity of nature has or may become the proper object of some theories of evolution (in physics, cosmology, biology, etc.). In such a case, the latter will function as theoretical evidence for the ontological claims made in the other branches of science. But any claim concerning uniformity of nature would be ontologically partial - i.e. pertaining to different aspects, such as constancy, continuity, or lawful evolution, and even different macro-, and micro-cosmic regions of what we call generically 'nature' - and theoretically conjectural and fallible. And this is as it should be once we are prepared to admit that

uniformity of nature is a theoretically dependent class of ontological claims on a par with many others. Thus both causation and uniformity of nature are structural patterns of what we theorize and claim nature is, quite independent of the empirical evidence that might be used relative to the theories and claims themselves. To assume otherwise is to prejudge the results of knowledge in order to keep it working, and working safely. As I have tried to show, only atheoretical knowledge needs such (eventually self-defeating) safeguards.

2. If evidence and claim are distinct, what is the relation between them? If the former pertains to justification and the latter pertains to truth, what relation holds between justification and truth? Many philosophers, both inductivist and noninductivist, believe that the relation is a *logical* one, and reconstruct it in such a way as to make evidence part of claim, and justification (or confirmation, or corroboration) part of truth, even if the latter is only tentatively assumed. For the inductivists in search of a probabilistic formalization, partial inclusion and its measure become the formal standards for dealing with inductive justification. This reconstruction is largely responsible for conceiving of the latter as being inferential and/or measurable within an interval bound by logical truth and contradiction, respectively. But this seems to be just the other side of Hume's atheoreticity. For we are again contemplating knowledge moving between logical reason and pure experience. Theories are just transitional mediums, almost eliminable once the partial inclusion between empirical evidence and a hypothesis is established and the evidence is logically distributed over the domain of logical truth or maximal probability with respect to the hypothesis considered. The strength of the evidence is a function of this distribution, while the very criteria of distribution belong to logical conceivability.

My basic objection to this approach, no matter how probability itself is interpreted, is that logical conceivability of the relationship between evidence and claim is not the same with the theoretical conceivability of that relationship, particularly when the former also incorporates certain linguistic assumptions. We still do not know very well how theoretical conceivability works, but we do know some of the formal and linguistic paradoxes, riddles, and difficulties generated by the attempt to account for induction in terms of logical-cum-linguistic conceivability. Using Hume's terminology, the objection is that the quest for a demonstrative reasoning (in this case, logic plus probability calculus) is not independent of the medium that makes such a reasoning possible. And the medium is a certain theory and its methodological machinery. Scientists do conceive formal models (both

logical and probabilistic) and apply them to experimental data but the models themselves are conceived within and in terms of a certain theory. They are not just invariant syntactical structures. Furthermore, and very importantly, the application of such models to empirical data, the feedback relevance of the latter to the former, and the theory they belong to, depend on further theoretical evidence and methodological assumptions (see Rosenkrantz (1971)).

A rather similar objection applies to the deductivist account of the relationships between empirical evidence and the claims made by a theory. For just as there is no pure experience prior to the establishment of a theory and directly available for probabilistic treatment, there is no such experience available for theory application, testing, and deductive subsumption either. In both cases, as either input or output, we have to consider methodological assumptions, various pieces of theoretical evidence, etc., which will define the experience in question as being relevant. I do not see how a purely deductive methodology can account for that. There is again a complex theoretical-cum-methodological medium that makes the deductive inference from claim to evidence possible, if at all. But it is at the level of this medium that the relationship between evidence and claim is first established.

My point can now be formulated at a higher level of philosophical generality. Any attempt to account for the relation between evidence and claim, or justification and truth, as being a logical, probabilistic, or in general an invariant relation, will face the objection, which I find very plausible, that a reality as posited by a theory is not logically 'transparent' in relation to experience. A reality is posited or claimed to be so-and-so by a theory, and experience is selected and brought to bear on such ontological claims or posits. But there is no logical or invariant relationship between these two acts, and no basis for either inductive or deductive inference unless we have a perfect algorithm for knowledge to function as a formal medium between what we experience and what we claim there is beyond experience. But there is no such algorithm, and this is essentially why our knowledge is hypothetical, theoretically-dependent and problem-oriented, and why its justification is contextual. If a formal medium is expected to relate conceptually homogeneous entities, a piece of empirical evidence cannot share a purely formal relationship with a theoretical law, unless the latter is just an amalgamation of the former (which seems unacceptable) or there are nonlogical assumptions and procedures in the first place governing the relationships between evidence and ontological claims. Which brings us to the very problem of local induction.

A most plausible relation between evidence and claim seems to be

that of *relevance*. Basically it amounts to bringing evidence to bear on what we claim the world is, and evaluating the difference it makes with respect to such claims. The first step is mostly methodological, while the second is evaluational. The criteria of evaluation will belong to a rational strategy of local justification. The discussion of these criteria goes beyond the scope of this paper, but there are several relevant approaches to this problem which the reader might be interested in: Levi (1967), and (this volume); Lehrer (1971), (1973), and (this volume); Niiniluoto and Tuomela (1973); Hintikka and Hilpinen (1966); Salmon and Greeno in Salmon et al. (1971).

3. It is now obvious that the way in which evidence may be inductively relevant to an ontological claim is relative to a theory. The problem of local induction will then be the following: under what conditions and according to what criteria can a certain evidence be inductively relevant to an ontological claim made by a certain theory? Granting that in any scientific inquiry a theory (or a set of hypotheses) makes certain ontological claims, (i) how and according to what criteria does that theory define and select the relevant empirical evidence in a nonarbitrary manner and relative to alternative theories and auxiliary sciences (as theoretical evidence), as well as methodological assumptions, etc.? and (ii) how and according to what criteria does such a theory get from that evidence reliable feedbacks that would improve, refute, or change it - and in general constitute a rational basis for decisions and evaluations concerning its ontological claims, and alternative ones?

It should be noted that the problem of local induction is not only a problem of what is relevant to what, and what follows from this, but also a problem of when this is so. Most advocates and critics of inductive justification assume an invariant structure of justification. But local justification is not only relative to certain contexts of inquiry but also to certain *stages* of inquiry. And this applies to both the selection of relevant evidence, and the evaluation and choice of hypotheses or theories. For example, there is more supporting theoretical evidence, there are easier methodological ways of bringing relevant empirical evidence to bear on ontological claims, and there is less competition among the latter when an indisputable paradigm dominates a certain field of research than when several theories compete for dominance. But the distinction is by no means absolute. Open inquiries involving evidential and theoretical competition may also occur within a dominant paradigm, for no such paradigm is ever so perfect as to be entirely closed and free of internal dissent.

Moreover, there is a simple fact of cognitive life that also militates against an absolute distinction: in both cases, as considered above, knowledge is functionally stimulated by problems or difficulties or discrepancies to be solved. In other words, such problems are functional invariants of knowledge no matter what the stage of an inquiry is; nevertheless, the characteristics of the latter will define the problems as open or closed, depending on the availability of effective procedures of solution, and this will influence the structure of justification⁹.

As a methodological aspect of local induction, bringing evidence to bear on the ontological claims made by a theory is associated with other methodological criteria and procedures such as correspondence rules, criteria of selection of a reference class and of application to single cases, empirical interpretation of objective probabilities, criteria of significance and decisiveness of empirical tests, application of formal calculi and models to experimental data, etc. The suggestion is that an adequate understanding of the problem of local induction cannot come alone but as a part of a broader methodological enterprise.

Many philosophers seem worried that a local approach to induction may become a new refuge for subjectivism. Their question is: How can different contexts of inquiry, different bodies of evidence that are theoretically selected, promote objectivity and agreement? I think that such worries still reflect atheoretical views of knowledge according to which only logical reasoning and incorrigible experience can constitute sources of objectivity and agreement. It is rather theories that should be taken, even if hypothetically, as starting points for objectivity and agreement. Scientists seem to agree more easily on what a theory claims than on which empirical evidence is certain, if any. Initial empirical evidence is irrelevant if considered outside a theoretical context, i.e. as experience we happen to have. Within a theoretical context, on the other hand, any body of empirical evidence brought to bear on a new theory is also accountable in terms of previous or alternative theories *plus* interpretative or auxiliary theories. This is, I think, a basic fact of scientific methodology as emphasized by the historico-critical reconstruction of science. Thus, there is no relevant empirical evidence without theoretical evidence. It is in the confrontation of ontological claims that our hope for objectivity lies.

What a theoretical approach to knowledge and a local approach to inductive relevance bring about is a sort of *gestalt* switch: that is, seeing knowledge as a move from theories to other theories *via* experience instead of seeing it as a move from one body of experience to another *via* theories. Experience is called upon to 'explain' such inter-theoretical moves - and this

is an essential function of local induction. But experience no longer enjoys the absolute status of a prime mover and of an independent and incorrigible source of objectivity, agreement, and cognitive safety - unless we revive Hume and his policy of minimal involvement: "As long as we confine our speculations to *the appearances* of objects of our senses, without entering into disquisitions concerning their real nature and operations, we are safe from all difficulties, and can never be embarrassed by any question" (Hume (1739), p. 638).¹⁰

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NOTES

1 To my knowledge, the logical problem of induction in terms of medium and demonstrative reasoning is much more explicitly stated in Hume (1748) than in his (1739).

2 To see (as Hume did) in (A) and (B) the same inference facing the same logical problem, the difference being only terminological, is an indirect anticipation of some subsequent developments in the philosophy of knowledge and induction such as Carnap's notion of (theoretically free) qualified instance confirmation or the instrumentalist account of theories and scientific systematizations.

3 "When it is asked, *What is the nature of all our reasonings concerning matters of fact?* the proper answer seems to be that they are founded on the relation of cause and effect. When again it is asked, *What is the foundation of all our reasonings and conclusions concerning that relation?* It may be replied in one word, *experience*. But if we still carry on our sifting humor, and ask, *What is the foundation of all conclusions from experience?* this implies a new question ... (Hume (1748), p. 32).

4 Where, let us remember, *proofs* are exactly "those arguments which are derived from the relation of cause and effect and which are entirely free from doubt and uncertainty" (Hume (1739), p. 124).

5 In this context, Hume paid serious attention to the (probabilistic) problem of causal contrariety, a remarkable anticipation of some aspects of statistical

explanation and ambiguity: see (Hume (1739), Bk. I, Part III, Sec. XI-XIII); Hempel (1965) Ch. 12; and Salmon (1971). Interestingly enough, a good deal of the recent controversies on this topic is still revolving around the inferential-cum-causal standards to be attributed to, or denied of, statistical explanation.

6 "[Resemblance] is a relation without which no philosophical relation can exist; since no objects will admit of comparison ..." (Hume (1739), p. 14). The ideas of connection, cause, necessity, and secret power will also depend on that of resemblance: see «1739), pp. 164-5; and (1748), pp. 76-79).

7 See Popper «1959), Appendix *X, §1; (1963), Ch. 1, Sec. IV) for a critical discussion of Hume's theory of induction from this angle. See also Quine (1969).

8 This seems to be the case with representational theories (concerned with the structure and mechanism of the material systems involved) rather than with black-box or phenomenological theories (concerned with the external behavior of such systems): see Bunge (1964). Significantly, the latter rely much more on experience than on hypothetical theorizing, and seem to need a principle of uniformity of nature as a *ceteris paribus* clause designed to take care of the box' inside. It seems to me that Hume's epistemology as well as many varieties of empiricism take as models such phenomenological theories.

9 This applies to the evaluation and selection of evidence (see Lehrer (1971), (1973); Schick (1970); Hilpinen (1970)» as well as of hypotheses (see Levi (1967); Hintikka (1967); Hempel (1965), Ch. 2; Niiniluoto and Tuomela (1973); Niiniluoto (this volume).

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