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EVOLUTIONARY EPISTEMOLOGY AND THE SCIENTIFIC METHOD

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What is the proper attitude of the evolutionary epistemologist towards science ? Should he regard science as disclosing (or aiming to disclose) information concerning the way the world is in itself, independently of the species-specific needs, bias and cognitive orientation of the human life-form ? Or should he conceive it as intrinsically limited and indelibly marked with the stamp of his own humanity ? Either way there is a problem. If he adopts the first, objectivist, interpretation he faces the charge of hypocrisy; why does he not extend the results of his conjectures concerning cognition in other species to the enquiring animal, man ? To make that extension, and to regard our scientific knowledge as biased and limited in ways analogous to those attributed to the lower animals, is, however, to breed a deeper discomfort. For if he adopts a species-specific, non-objectivist account of scientific knowledge then the status of the evolutionary conjecture itself is brought into question. For by what right does the evolutionary theorist then quantify over all evolved life-forms in formulating his general picture of the relation between cognition and reality ?

1. An evolutionary epistemologist[1] extends to mind and knowledge that account of adaptive nature and purpose usually reserved for the explanation of gross physical characteristics; characteristics such as sharp teeth, long necks or acute hearing. This extension is hardly unwarranted. Obviously, neither sharp teeth nor sharp ears will contribute to the proliferation of the genes concerned if they are not combined with an appropriate control system (call it 'mind') translating input into survival-enhancing action. Sight of prey or sound of predator must be suitably processed or interpreted to result in use of teeth or use of feet accordingly. Nature must be red not *just* in tooth and claw, but in instinct and desire also if the

teeth and claws are to be put to good use.

On the plausible assumption that basic cognitive orientation or instinct is as adaptively strategic as gross bodily form the evolutionary epistemologist brings his selective paradigm to bear on the issue of the relationship between an animal's environment (as we recognise it) and its knowledge of that environment (as expressed in its observable behaviour). He is concerned to account for the form and content of that knowledge in terms of the process of random mutation, recombination and differential survival to reproduce; a process known familiarly as natural selection.

By imposing the selective paradigm onto the matter of basic cognitive orientation the evolutionary epistemologist can explain, at a stroke, both startling achievements and apparently perverse inaptitudes. The location of food sources is understandably high on the honey-bee's 'list of priorities' so we can make good (albeit post facto) sense of the evolutionary development of the amazingly intricate dance routines and mutual interpretative capacities used to communicate information concerning the distance and direction at which food is to be found. Bee-dance, we conjecture, is choreographed by the selective process itself. Attention to the details of this process helps to explain not only what various animals *can* do, but also what they cannot do, cognitively speaking. The water-shrew, for example, is distinguished in the literature (Lorenz*1* trans. page 32) mainly in virtue of its incapacity to find a shortcut (literally) to save its life. For having once laid down a route to B from A via C, it can never progress to a direct route A → B even if the trip to C involves a long, looping detour. This cognitive 'deficiency' is explicable too (in a way more precisely detailed below) once we cosider that it lives and reproduces perfectly successfully in default of any capacity to sustain the complex internal representations of its environment necessary to determine a short-cut.

A theoretical model adequate to the explanation of both cognitive achievements and inaptitudes is available to the evolutionary epistemologist. For the process of natural selection is characterised by a pervasive dual aspect. On one hand, there is the pressure to survive; this brings the species into mental and physical contact, over evolutionary time, with the environment in which it is competing. On the other hand, there are the limitations inherent in the rather minimal goal (viz. survival and reproduction) ascribed to the selective process and responsible for the 'contact with reality' which it can support. For a process geared solely to survival may be

expected to yield limbs and cognitive strategies alike which are geared to the special needs of a given being in a given niche. Further slack with any notion of absolute veridicality enters with the observation that the whole process is *blind* where by this is meant that the options among which selection takes place are random mutants; beings whose particular mutated nature stands in no causal relation to the nature of the environment in which they are to be 'tested'. And, finally, the selective process is to be deemed sensitive to the non-optimising demands of cost-efficiency. If a neat approximation is both effective and economical it will be selected for against a more detailed but energy-intensive rival.[2] Considerations of cost-efficiency, species-bias and random generation may thus explain the various inaptitudes of lower animals in the same theoretical context which explains their successes.

The selective model thus briefly sketched, we may now ask after the appropriate attitude of the evolutionary epistemologist towards his own (human) conception of reality. Is he simply to extend the account of basic cognitive capacities (instinct, degree and nature of internal representation of the environment, input-action transformation strategies) in lower animals to man himself ? Or is science supposed somehow to be exempt from any repercussions of the constraints on basic cognitive content discussed in 1 above ?

In his dialings with the knowledge of other species the evolutionary theorist stands committed to what Donald Campbell has called 'an organism-environment dualism' (Campbell[1] 449). This dualism is both ontological and epistemological. It is ontological insofar as the world must be conceived as physically independent of mind; it is a mind-producing, not a mind-produced, system. And it is epistemological insofar as it involves a dualism of knowledge and reality; how the universe is (in itself, as it were) may always transcend how a given type of being knows it to be. One way to put the present question is to ask whether science can intelligibly aspire to transcend this latter basic epistemological dualism and leave behind the random, species-biased and cost conscious character of the process which made the brains which *do* science. To suppose it cannot is to call into question the objective validity of the evolutionary model (itself a branch of the biological sciences) itself and hence to intimate that the naturalised angle on knowledge is a self-undermining one. To suppose it can is to invite the accusation of ignoring our own epistemic situation as human

beings,[3] for whence the phylogenetic discontinuity between the knowledge of the lower animals and that attained by man ? Is there safe water between the Scylla of cognitive imperialism and the Charybdis of cognitive relativism ? And if there is, can it be consistently occupied by an evolutionary epistemologist ? To reach a decision we must take a closer look at the scientific method itself.

2. On any plausible view of the scientific method the conduct of science involves the performance of some range of cognitive operations upon some choice of data. The cognitive operations may include some kind of ranking of competing explanatory hypotheses in terms of the delicate balance between simplicity and comprehensiveness and utility (Sober calls this the trade-off between simplicity and fruitfulness). And the data may be in the form of direct observational reports or it may be more or less impregnated with theory depending perhaps on the extent to which previously accepted hypotheses are assumed in the construction of the evidence upon which some current claim is to be based. But no matter how intricate the web of intervening theory it will remain at root true to say that science takes observational reports as inputs, generates explanatory laws and models as outputs, and decides amongst competing laws and models by employing considerations of simplicity and fruitfulness. The explanatory laws and models which get accepted are therefore subject to two sources of constraint. The first source lies with the observed phenomena themselves; a theory must be true to the facts. The second source lies with the structure of human (and perhaps all) rationality; a good theory should be simple, beautiful, comprehensive, suggestive and so forth.

It would be natural to think that if some species-based epistemological infection were to afflict science, the site of the infection would be with this second source of constraint. Sober, indeed, has suggested that it might be unwarranted to believe that any cognising being must share the kind of human rationality evinced by reference to the 'parochial feature(s) of our own adaptive machinery' (Sober[2], p. 117). And this could well include the kind of heuristic constraints mentioned above. Against this it may be held that some features (such as the desire for simple hypotheses) may naturally result from demands of informational economy derivable from the broad evolutionary bias towards cost-efficient and prompt processing of data. This option too is signposted by Sober. I think, however, that it is a mistake to see the scientific issue as essentially

bound up with our attitude to the heuristics at all. For the prime site of empistemological infection must lie, I shall now argue, with th range and nature of our access to phenomena and hence with the *first* source of constraint on scientific theories. Even if we are obectivists about the heuristics (taking them as essential to any rational approach) this will not be sufficient to insulate science from the shock waves of the evolutionary account of our sensitivity to observational data. And if we hold the heuristics to be contingent, biased and unprivileged too, then so much the worse for a traditional scientific realism.

The observation that one of the two major constraints on scientific theory-building is to keep faith with the phenomena (to save the phenomena, as Duhem puts it[4]) ought to be enough to transmit some of the basic evolutionary infection of bias and limitation to the body of scientific knowledge itself. For to admit that science aims to explain and systematise the phenomena is to tie the possible content of science to the range and nature of the phenomena accessible to the particular biological organism designated 'man'. It is at just this point that any thoroughgoing scientific realism which would see science as penetrating to the unique noumenal roots of nature must founder against the evolutionary rocks. For what is accessible to man (the bare observational data to which all theoretical constructions must answer) is determined by the very same contingent, species biased and limited modes of sensory access and basic processing to which the evolutionary scenario of section one unequivocally applies. Even the instrumental augmentation of human sensory capacities must answer to some checks in gross observational accuracy or we would have no cause to accept such augmentation as in any way veridical. Science, for all its sophistication, thus looks unable to transcend completely the humanity of its observational base.

Science, thus conceived, partakes of the dual aspect of all evolved cognitive modes (albeit by a more indirect route). In being faithful to the phenomena it maintains the original tie established by the selective process between the phenomena as known by a being and the real world in which the being must live. Yet by dealing only with the phenomena which happen to be experienced by human beings it inherits also the species-specific interests and random caprices of fate which combined to render accessible those particular aspects of reality in that particular way. According to which of these two aspects of the phenomena are stressed we get a

more or less realistic picture of the activity of science.

3. Just how much realism does the evolutionary account require if it is not to collapse under its own weight ? To get some idea we may consider a typical evolutionary claim. The claim is that :

> The hydrodynamics of sea-water, plus the ecological value of locomotion, have independently shaped fish, whale and walrus in a quite similar fashion ... But the jet-propelled squid reflects the same hydrodynamic principles in a quite different ... shape. (Campbell[1], p. 447)

For such claims to be intelligible the evolutionary theorist must claim some right to employ our scientific account of the hydrodynamics of sea-water as descriptive of the common reality to which both fish and squid are adapted. In some sense then the world revealed by science must be justifiably taken to describe the mind-independent environment in which adaption has occurred.

Is such a role for science compatible with the evolutionary epistemologist's account of cognitive limitation and bias, supposing that account to be extended to include our own sensitivity to phenomena ? I think it is, and one way to show how this is so is to focus on the idea of science as *modelling* an extra-experiential reality.[5]

The notion of a model seems a particularly apt one for the evolutionary epistemologist to employ. For there is no implication that a model is a perfect replica of what it models. Rather, we conveive a model as bringing out particular features of some real-world entity, perhaps to the exclusion of other features. And just *what* features are stressed will depend (a) on what information the modeller has at his disposal and (b) on the particular needs and interests which the model is designed to serve. These two features correspond satisfactorily to the contingency of the range of real-world phenomena to which man has direct observational access and to the particular kind of interest which man's needs and the nature of the human brain allow him to have regarding the accessible realm.

We may now clarify the nature of the proposed linkage between our scientific models and extra-experiential reality by introducing a special relation of tolerance. Thus we may call a basic cognitive strategy or sensory modality (let P stand for this disjunction) *tolerated* by the adaptive environment iff

> P affords a means of classifying, predicting or reacting to things and events which, when applied by beings of a given biological constitution in a given niche makes for successful (= survival enhancing) action in the world.

And we may call a scientific theory P' *maximally tolerated* by extra-experiential reality iff

> P' affords a means of conceiving of things and events which, when applied by beings of a given biological constitution, enables them to account for successfully (= explain and perhaps predict) all the phenomena accessible to a being so constituted.

P' is then to be conceived as an ideal scientific model in the sense of model outlined above. Such a model is then related to the real world it models by virtue of the relation between the phenomena it explains and the world, such links being constituted by the original tolerance relation between P and the environment. The justification for calling P' a model of the real world thus rests squarely on the evolutionary justification for taking the phenomena which are modelled to be appropriate (if partial and biased) representations of the world they cope with.

A true scientific theory, we may now say, would be one that is maximally tolerated by the reality accessible to man.[6] And there will be an infinite gradation of tolerances between the minimal (accounting for only a small number of phenomena) and the maximal (accounting for *all* the phenomena). No maximally tolerated theory has yet been found, and perhaps none ever will be. But the crucial point is this; even if one *were* found, still the reflexivity of the formulation of the tolerance relation (its relativisation to *human* and contingent capacities) would rob it of any claim to be the one unique metaphysical truth fated to be agreed by all rational beings.

The intelligible goal of science, we may now say, is *not* the description of the world-in-itself but the production of more and more highly tolerated models of the world we find around us. And a model is, ultimately, nothing more or less than a useful arrangement of information. Just *what* arrangements of information we find useful will depend on our human needs and capacities and the particular cognitive orientation we happen to possess. Thus, to give a simple example, a program written in Cobol would not prove a

useful arrangement of information for a computer which could only process commands coded in Basic.

The strong conclusion to draw from the picture of science as aiming at tolerated models would be that even at the ideal limit of human enquiry there might be a plethora of available models all of which are observationally and heuristically adequate (such a conclusion is endorsed by Putnam[3] 1—25). For our purposes, however, something weaker will do. We may conclude simply that the one model (if one is all there is) at the ideal limit of human scientific enquiry is still not the only possible 'correct' representation of reality *even if* relative to our cognitive constraints and observational access there are no visible alternatives. In other words, given the natural possibility of alternative life-styles, needs, capacities and cognitive structures it makes no sense to identify our ideal scientific model of reality with the ultimate nature of the world-in-itself. A model is still just a model, it is not the one true description worshipped by the metaphysical realist. Just because we do not regard our models as unique or necessary, however, does not mean we may not regard them as valid representations, in the light of our interests and structure, of the available information. It is this combination of cosmic contingency and limited objective validity which allows the evolutionary theorist his scientific account of the common adaptive environment while admitting the cognitive bias and limitations implied for man by the adaptive account itself.

One interesting consequence of this analysis is that we must accept the possibility of alien epistemologists (perhaps even alien evolutionary epistemologists) working successfully with a different model of the 'common reality' to our own ! Such epistemologists may even diagnose man's models as a natural and explicable outcome of our own biological nature as it appears to their science. We, of course, might do the same for them ! Each scientific model would therefore be sufficiently powerful to embrace the working of the other. The question as to which model is the correct one would never be raised.

4. The question finally arises whether the spectre of the world-in-itself, apparently attendant upon the epistemological dualism diagnosed in 1 above, has been successfully exorcised or merely relocated ? For to adopt the quasi-realistic notion of science as aiming to produce tolerated models is to invite the philosopher's retort 'models of what ?'. Two courses are open to the evolutionary

epistemologist here. He may allow that all such models are models of the one (alas indescribable) objective, mind-independent reality to which all beings are variously adapted. Or he may dig in his heels and refuse to countenance any conception of reality save that of whatever is said to exist by some successful model (be it a human or non-human one). So *either* we give up the very idea of the world-in-itself (as Rorty and Davidson urge us to do[7]) and replace it with the notion of multiple valid species-specific descriptions whose objects are determined by the descriptions themselves, or we retain the idea of the world-in-itself as a bare noumenal something = X which somehow supervenes (or maybe transcends) the totality of possible descriptions of it. Whichever we choose, the divorce of science from the description of noumenal reality is ratified.

Of the two options suggested, I find myself attracted to the more austere alternative of dropping the notion of the world-in-itself entirely. The dualism of organism and environment would then remain as a part of the theoretical model of biological science, which model itself would be regarded as non-unique and cosmically unprivileged. But there would be no need to assume, *in addition* to this, that all the possible models of reality *themselves* stand on one side of a dualism of models and the world-in-itself. Aside from the general thought that the idea of the world-in-itself can now be seen as theoretically spurious to the evolutionary account (which requires only the acceptance of an organism-environment dualism within a given explanatory model which takes *science* to provide the necessary account of the environment) there are two reasons which tell in favour of abandoning the notion. The first is the recent and influential polemic launched by Hilary Putnam (see notes 3 and 6) against the notion of there being one true (if unknown) description of how the world is. Such a belief, Putnam argues, can be shown to be false on model-theoretic grounds alone. The second reason has to do with the intelligibility of the very idea of the world-in-itself. For such a world looks to be *necessarily indescribable* (description implying point of view, cognitive bias and so forth). But to claim that something about which we can necessarily say nothing exists may be to claim nothing which we can properly grasp at all. For any such claim looks distinctly dubious in the light of Dummett's recent investigations into meaning. If we accept, with Dummett[8], that meaning attaches to statements in virtue of our capacity to recognise when the circumstances described by the statement actually obtain, we may still make sense of the minimal

evolutionary claim viz. that various models may succeed in coping with reality (we may observe the survival and achievements of beings employing such models). But what *further* evidence could there be to warrant us in assenting not just to a plethora of models but to there being one, ultimate, unknowable way the world actually is beyond how it appears in the various models we, or any other sentient being, might construct ?

In choosing therefore to give up the notion of the world-in-itself the evolutionary epistemologist must simultaneously resist Rorty's alternative description of reality as whatever *human beings* can agree at a given time exists. (See Rorty WWL[7] p. 661—663). For human beings, we have seen, can recognise the bias and contingency of their own descriptions of reality from a position *within* biological science. To simply *identify* 'the world' with the world of man is, we may be sure, mere anthropomorphic conceit. The alternative, recommended in this paper, is to embrace the difficulty of admitting multiple valid descriptions and to assert that to be is to be perspectivally.

Finally, let us observe that the denial of any privileged status to the model of human science renders our whole account of the tolerance relation itself harmlessly self-referential. For our theoretical models are ultimately justified by keeping faith with observable phenomena. These observable phenomena are, on the theoretical model of evolutionary theory, accessed and characterised by sensory capacities and basic forms of processing which have stood the test of survival. They are hence assumed to constitute a species-valid arrangement of information concerning the external world. Theory is thus justified by theory in a cosy epistemological circle of the kind sometimes described as 'virtuous'[9]. A direct consequence of this is that our belief in the relation of tolerance is *itself* justified only as a tolerated belief. It is thus an acceptable representation, for beings of our knowledge and constitution, of the relation of sense and thought to an external reality. But we may not elevate the scientific model which employs the idea of tolerance to the level of a unique or metaphysically privileged representation of the relation of thought and sense to the world. The evolutionary epistemologist dare not claim to possess the one true account of the relation between mind and the material realm. The best he can do is to say that it is *an* account, acceptable to us, and one which avoids the metaphysical excesses of a traditional scientific realism. As Clive James once observed :

There are limits to the altitude that can be achieved by hauling on one's own bootstraps.[10]

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NOTES

[1] Examples of work in Evolutionary Epistemology would be Campbell, D., 'Evolutionary Epistemology' in : Schilpp, (ed.), *The Philosophy of Karl Popper*, Open Court, Illinois, 1974). Lorenz, K., 'Kant's Lehre vom Apriorischen im Lichte gegenwärtiger Biologie' in : *Blätter für Deutsche Philosophie* 15, 1941. Translated in L. Bertalanffy and A. Rapoport (eds.), *General Systems*, Ann Arbor, 1962. Or Tennant, N., 'A defence of Evolutionary Epistemology' in: *Theoria* vol. IL 1983, part I.

[2] These constraints are signposted by both Tennant and Campbell (see note 1 above) and also by Sober, E., in: 'The Evolution of Rationality', *Synthese*, vol. 46, no. 1, Jan. 1981.

[3] The very same accusation is made by H. Putnam against his earlier metaphysically realist self in the introduction to *Realism and Reason* C.U.P., 1983, vii, xi.

[4] See Duhem, Pl, *The Aim and Structure of Scientific Theory*, New York, Atheneum, 1974.

[5] This kind of account of science is most fully developed in: van Fraassen, B., *The Scientific Image*, Oxford, Clarendon Press, 1980.

[6] This corresonds with Putnam's idea of truth as the ideal end-point of the series of warrantedly assertible claims concerning the nature of reality which *human beings* could in principle come to make. See Putnam, H., *Reason Truth and History*, C.U.P., 1981,3 4.

[7] See Rorty, R., The world well lost' (WWL) *J. Phil.* vol. LXIX, no. 19, Oct. 1972, and *Philosophy and the Mirror of Nature*, B ackwell, Oxford, 1980. Also Davidson, D., 'On the very idea of a conceptual scheme' in : *Proceedings of the American Philosophical Association*, vol. 47, 1974, 5—20.

[8] See especially Dummett, M., 'The philosophical basis of intuitonistic logic' in: *Truth and Other Enigmas*, Duckworth, London, 1978.

[9] The terminology is, I think, due to Rescher. A virtuous circle is

one which provides an improvement in understanding in spite of any element of self-reference involved. Thus, in the present case, we learn, by the *application* of our understanding, something of the reasons why we might *trust* our understanding to reveal something of the world in which we evolved.

[10]James, C., *Unreliable Memoirs*, Picador, London, 1981, 35.

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