

PHILOSOPHICAL LECTURE
IN DEFENCE OF OBJECTIVITY

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I

VARIOUS intellectual and moral tendencies are currently combining to dethrone natural science from the sovereignty of reason, knowledge, and truth which it has enjoyed since the seventeenth century. Far from being the paradigm of objective truth and control which will make us free of all natural ills and constraints, science is increasingly accused of being a one-sided development of reason, yielding not truth but a succession of mutually incommensurable and historically relative paradigms, and not freedom, but enslavement to its own technology and the consequent modes of social organization generated by technology. It is with the intellectual, rather than the moral or practical, sources of these criticisms that I shall be concerned here. I want to try to discriminate among various aspects of the implied attack on scientific objectivity, and to consider how far and in what sense claims to objectivity can be maintained.

During the last half-century much of professional Anglo-American philosophy of science has been devoted to detailed development of the internal logic of natural science based on empiricist criteria, and also to attempts to show how this logic applies also in the social sciences and in the study of history. Suggestions such as those deriving from the traditions of Dilthey or Weber to the effect that there are other modes of knowledge than the empiricist were sometimes actively resisted but more usually totally disregarded. The corollary was that *if* the human sciences are to attain knowledge-status at all, *then* their method must conform to some acceptable modification of that of the natural sciences, whose own method, it was claimed, was in all essentials thoroughly understood. During the same period continental philosophy has on the whole ignored these technical analyses of science. Sometimes, as in Husserl and Heidegger, natural science was the subject of negative assessment of its credentials and value as a claim to knowledge; more

usually a late nineteenth-century form of instrumentalism has been uncritically accepted as the last word about such claims. However, in the post-war period two continental traditions have become more self-conscious about problems of epistemology and method, although neither of them has been primarily concerned with natural science. These are the mainly Protestant schools of Biblical exegesis, and the Marxist-oriented schools of political and social philosophy. In both traditions the term 'hermeneutic' has been adopted to indicate concern for knowledge as *interpretation*, sometimes explicitly distinguished from what is taken to be the direct, literal, uninterpreted modes of description proper to the natural sciences.

The basic problem of hermeneutics may be briefly expressed by an analogy more familiar on the English philosophical scene, namely the so-called 'paradox of analysis'. Just as a paradox seems to arise when more precise logical or conceptual tools are used to analyse ordinary vague usage of language, because the product of such analysis is not then identical with what was analysed, so in a much more general sense a 'hermeneutic circle' arises when the language, categories, and frameworks of our own culture are used to interpret and understand alien texts, alien cultures, and even other individuals and groups in our own culture or society. This is because the language and thought forms we are studying are not in themselves intelligible without interpretation, but our own language and thought forms are not adapted to fit them, therefore interpretation is always problematic and accompanied by distortion. The hermeneutic circle is held to arise particularly in studies of the human rather than the natural world, just because, it is claimed, human subjects have their own understanding and interpretation of their states and activities, whereas physical and biological nature does not. Nature can therefore be understood externally and objectively in terms of our categories without distortion, human societies cannot.

Apart from such characterizations as this, there is as yet little detailed investigation of the credentials of the hermeneutic method, certainly not such as would satisfy Anglo-American-trained philosophical analysts. There is, however, an impressive corpus of examples of the problems to which it is claimed to be relevant, ranging through interpretations of New Testament and other esoteric texts, studies of primitive ritual and myth, and in general cross-cultural and cross-ideological investigations, to the historical and contemporary study of psychiatry and the modes

of madness. This is not the place, neither do I have the capacity, to attempt a detailed analysis of hermeneutic methodology. What I want to do is rather to compare its implied distinction between methods in the natural and human sciences with a potentially more radical development within the historical and philosophical analysis of natural science itself. For the imperialism previously claimed for natural science in the empiricist tradition has now turned in some quarters into its opposite, namely an assimilation of natural science itself to something approaching the hermeneutic critique. This critique comes both from philosophers of science dissatisfied with logical empiricist accounts of the structure of science and from historians of science who have been brought to question the theory of a 'demarcation' of science from other attitudes to and theories of the natural world, in the light of the similarities and continuities between 'science' and 'pre-science' or 'non-science' that can be found in its history. Study of witchcraft cults among the Azande is not apparently so different in its methodology and philosophical moral from, say, study of Stoic physics.

It is convenient to take as starting-point a perceptive discussion by Jurgen Habermas of the similarities and differences between empirical and hermeneutic method in his book published in English as *Knowledge and Human Interests*.¹ I shall consider first a group of distinctions concerning traditional problems of the language and epistemology of science, taken from his exposition of Wilhelm Dilthey. These are distinctions that I believe are made largely untenable by recent more accurate analyses of natural science. They may be briefly summarized in the following five points. (In considering these points in relation to hermeneutic method, it helps to keep in mind the least controversial type of application of that method, namely the study of history—consider some standard problem of interpretation, for example, the causes of the First Crusade.)

1. In natural science experience is taken to be objective, testable, and independent of theoretical explanation. In human science data are not detachable from theory, for what count as data are determined in the light of some theoretical interpretation, and the facts themselves have to be reconstructed in the light of interpretation.

¹ *Knowledge and Human Interests*, trans. J. J. Shapiro, London, 1972. An excellent analysis by an English-speaking philosopher of similar themes is to be found in Charles Taylor's 'Interpretation and the Sciences of Man', *Rev. Met.* xxv (1971), 3.

2. In natural science theories are artificial constructions or models, yielding explanation in the sense of a logic of hypothetico-deduction: *if* external nature were of such a kind, *then* data and experience would be as we find them. In human science theories are mimetic reconstructions of the facts themselves, and the criterion of a good theory is understanding of meanings and intentions rather than deductive explanation.

3. In natural science the law-like relations asserted of experience are external, both to the objects connected and to the investigator, since they are merely correlational. In human science the relations asserted are internal, both because the objects studied are essentially constituted by their interrelations with one another, and also because the relations are mental, in the sense of being created by human categories of understanding recognized (or imposed?) by the investigator.

4. The language of natural science is exact, formalizable, and literal; therefore meanings are univocal, and a problem of meaning arises only in the application of universal categories to particulars. The language of human science is irreducibly equivocal and continually adapts itself to particulars.

5. Meanings in natural science are separate from facts. Meanings in human science are what constitute facts, for data consist of documents, inscriptions, intentional behaviour, social rules, human artefacts, and the like, and these are inseparable from their meanings for agents.

It follows, so it is held, that in natural science a one-way logic and method of interpretation is appropriate, since theory is dependent on self-subsistent facts, and testable by them. In human science, on the other hand, the 'logic' of interpretation is irreducibly circular: part cannot be understood without whole, which itself depends on the relation of its parts; data and concepts cannot be understood without theory and context, which themselves depend on relations of data and concepts.

There are obscurities in the way these points have been set out which badly need investigation, particularly in relation to the concepts of 'interpretation' and 'meaning'. It is immediately apparent, for instance, that there is an ambiguity in the way 'meaning' has been used in relation to natural and human science respectively. 'Meaning' in natural science presupposes an account of the empirical reference of terms and of their intentional connotations within a scientific theory. The concept of

'meaning' in the hermeneutic sciences, on the other hand, is much richer, for it carries implications for the data that go beyond an external semantics of language. Data in the human sciences are said to be themselves constituted by 'meanings' in virtue of being the products of human language and intentions. Again, it is implied in the contrast drawn between the natural and human sciences that there is an unproblematic sense in which insight can be gained into human intentions, rules, and meanings which is different from the purely external understanding of nature. But it is by no means clear that this sense is so unproblematic. The thought forms of alien cultures may be so foreign to our own that it might make sense to say that I understand my dog, or even my chrysanthemums, better than I understand those people. This is not to say, of course, that I fully know what it is to understand my dog, if by this is meant more than an ability to teach him tricks and to predict his external behaviour. But it does suggest that the notion of understanding 'meanings' in some of the alleged applications of hermeneutic method need much more investigation. It is precisely one of the dilemmas facing students of alien thought and culture that the distinctions between external behaviour and meaning, cause and reason, are far from easy to draw.

Let us, however, concentrate for the moment on the natural science half of the dichotomy. What is immediately striking about it to readers versed in recent literature in philosophy of science is that almost every point made about the human sciences has recently been made about the natural sciences, and that the five points made about the natural sciences presuppose a traditional empiricist view of natural science that is almost universally discredited. In this traditional view it is assumed that the sole basis of scientific knowledge is the *given* in experience, that descriptions of this given are available in a theory-independent and stable language, whether of sense-data or of common-sense observation, that theories make no ontological claims about the real world except in so far as they are reducible to observables, and that causality is reducible to mere external correlations of observables. It is no novelty that all these empiricist theses have been subject to much philosophic controversy. It has been accepted since Kant that experience is partly constituted by theoretical categories, and more recently than Kant it has been generally held that these categories are not *a priori*, but are conjectured by creative imagination, having a mental source different from experiential stimuli. Moreover,

the work of Wittgenstein, Quine, Kuhn, Feyerabend, and others has in various ways made it increasingly apparent that the descriptive language of observables is 'theory-laden', that is to say, in every empirical assertion that can be used as a starting-point of scientific investigation and theory, we employ concepts that *interpret* the data in terms of some general view of the world or other, and this is true however apparently rooted in 'ordinary language' the concepts are. There are no stable observational descriptions, whether of sense-data, or protocol sentences, or 'ordinary language', in which the empirical reference of science can be directly captured. Paralleling the five points of the dichotomy, we can summarize this post-empiricist account of natural science as follows:

1. In natural science data is not detachable from theory, for what count as data are determined in the light of some theoretical interpretation, and the facts themselves have to be reconstructed in the light of interpretation.

2. In natural science theories are not models externally compared to nature in a hypothetico-deductive schema, they are the way the facts themselves are seen.

3. In natural science the law-like relations asserted of experience are internal, because what count as facts are constituted by what the theory says about their interrelations with one another.

4. The language of natural science is irreducibly metaphorical and inexact, and formalizable only at the cost of distortion of the historical dynamics of scientific development and of the imaginative constructions in terms of which nature is interpreted by science.

5. Meanings in natural science are determined by theory; they are understood by theoretical coherence rather than by correspondence with facts.

It follows, so it is held, that the logic of science is necessarily circular: data are interpreted and sometimes corrected by coherence with theory, and, at least in less extreme versions of the account, theory is also somehow constrained by empirical data. The resemblances between this account and the hermeneutic analysis of the human sciences seems so close that, among the more extreme post-empiricists, Feyerabend at least has drawn the explicit conclusion that scientific theories and arguments are closely analogous to the circular reinforcement of beliefs, doctrines, documents, and conditioned experience that

may be found in some religious groups, and in political party-lines and their associated techniques of propaganda.¹

II

There are some features of this post-empiricist analysis which I do not want to dispute here. I take it that it has been sufficiently demonstrated that data are not detachable from theory, and that their expression is permeated by theoretical categories; that the language of theoretical science is irreducibly metaphorical and unformalizable; and that the logic of science is circular interpretation, reinterpretation, and self-correction of data in terms of theory, theory in terms of data. Such a view of science is by no means new: it is to be found in all essentials in those fathers of inductive science, Francis Bacon and Isaac Newton. I shall later suggest a model of natural science as a *learning device* that can be made to represent such an account without abandoning the essentials of empiricism, and which shows that the logic of science implied in the account is virtuously rather than viciously circular.

There is, however, a further aspect of both the empiricist and post-empiricist accounts of natural science that has not yet been touched on, and which is of crucial importance for the comparison of natural and human science. This is the question of scientific *truth*, and the consequent credentials of natural science as a form of objective knowledge. In the early period of modern science it was plausible to believe, and indeed it was believed by both Bacon and Descartes, that natural science would be a continuously progressive, cumulative, and convergent approach to truth, where truth was understood as correspondence between a system of objective knowledge and the real world. It was therefore reasonable to adopt a *realist* interpretation of scientific theory as that which progressively discovers or uncovers the hidden essences of nature. It soon became apparent in the subsequent history of science, however, that there is no such cumulative approach to description of a real world of essences by scientific theory. The conceptual foundations and premisses of theories undergo continuous and sometimes revolutionary change, and this occurs not merely *before* the so-called scientific revolution in method of the seventeenth century, but subsequently,

¹ See in particular P. K. Feyerabend, 'Classical Empiricism', *The Methodological Heritage of Newton*, ed. R. E. Butts and J. W. Davis, Blackwell, Oxford, 1970, p. 150; 'In Defence of Classical Physics', *Studies in Hist. Phil. Sci.* i (1970), 59; and 'Against Method', *Minnesota Studies in the Philosophy of Science*, vol. iv, ed. M. Radner and S. Winokur, Minneapolis, 1970, p. 17.

when the method of science remained comparatively stable. The succession of theories of the atom, and hence of the fundamental nature of matter, for example, exhibits no convergence, but oscillates between continuity and discontinuity, field conceptions and particle conceptions, and even speculatively among different topologies of space.

The empiricist response to this instability of theory has been the positivist or *instrumentalist* view of science as constituted essentially by accumulating knowledge of phenomena or observables, rather than of the fundamental but hidden nature of things. This is the kind of knowledge that issues in technical application, the cumulative character of which cannot be in doubt. Thus the claim of science to yield objective knowledge comes to be identified with the cumulative possibilities of instrumental control rather than with theoretical discovery, and this in fact is the conclusion drawn by Habermas and most other hermeneutic philosophers when they come to compare the forms of objectivity of the natural and human sciences. However, this conclusion of empiricism has also come under fire from the post-empiricists, whose reinterpretation of the role of scientific theory also reopens the old debate between realism and instrumentalism.

Two features of the new analysis are relevant to this debate. First, it is held that successive theories so permeate observation statements that there is no stable observation language in which the empirical reference of science can be directly captured. It follows on this view that the objective corpus of scientific knowledge pointed to by instrumentalism does not form a neutral and accumulating expression of 'facts' discovered by science. Instrumentalism can no longer interpret the truth-claims of science as a body of empirical statements, but can at best point to the pragmatic effects of science to indicate its form of empirical objectivity. On the other hand, talk of the 'truth' of science, and of the ontology of objects which it presupposes, becomes wholly internal to scientific theory itself. Truth and existence-claims are determined, not by the world, but by the postulates of theory: for our physics *there are* fundamental particles and fields, a space-time continuum, forces, and persisting physical objects; for other cultures *there are* spirits, witches, telepathic communications, persons not uniquely and continuously space-time locatable, and so on and so on. It has been held to follow in this view that the currently accepted theory must supersede in all its implications even a natural descriptive language that

was pervaded by a previous theory. For example, the assertion 'the table is hard and solid' must be held to be *false* relative to the new language developed by physics, because current physical theory asserts that the table is a field of elastic repulsive forces, and is mostly empty space. Sometimes the corollary is also explicitly adopted, namely that the 'currently accepted theory', which thus determines the categories of observation, is accepted on wholly non-empirical grounds, and is in fact indistinguishable from myth or metaphysics. There is no room in this view for an objective account of scientific knowledge in terms of accumulations of true empirical statements, either theoretical or observational.

A more conservative conclusion from post-empiricist premisses is that not current theory, but current 'common-sense' observation sentences, should be given privileged status. In the light of critical demolition of the notion of theory-independent observation sentences, this view will not now be held on grounds of the relative stability of the observation language, but of the demonstrable *instability* of theories. If every theory is destined to prove inadequate and to be replaced by a theory differing radically in its concepts and laws, then, it may be argued, we are likely to have more direct evidence for, and to be more convinced of the truth of, common-sense descriptions than any theoretical descriptions. This is the view not only of instrumentalists in the philosophy of science, but also of all 'ordinary language' analysts who resist the claim that scientific theory may *change* 'what it is correct to say' in ordinary language, and of all phenomenologists who hold that some phenomenological reduction of immediate human experience is more fundamental than the 'objectifications' of science. Ironically enough, this is a view that also in its way implies a relativity of science to theory. For as soon as it is admitted, as it must be in the light of the findings of history of ideas and of anthropology, that conceptually very different 'common-sense' languages may be viable, and that a given language may radically change, the language appealed to by the 'common-sense' school must be conceived to change *irrationally* with external circumstances, and not as a result of any discovery or rational consideration of empirical truth yielded by science. This second view leaves no room for accumulating objective description of the empirical either.

There is, however, a third possibility, which does more justice to the sequence of theory systems as we actually find them

in the history of science. This is the view that successive theories supersede and reinterpret their predecessors, but without rejecting the empirical discoveries that they embody. The table can still be said in some sense to be solid, and this assertion retains some of the implications it previously had: balls will bounce on it, heads will crack on it. But other implications of the previous matter theory are now false: for example that it, or any part of it, is indefinitely divisible into homogeneous pieces of stuff, that it has mathematically sharp surfaces or edges, and so on. Moreover, the new theory does not just contradict parts of the old theory, it also explains why the old theory was as good as it was and what its limitations are: that it is a good approximation only in the case of macroscopic objects, moderate velocities, etc. This implies that something remains constant from theory to theory. What that something is can best be expressed by pointing to classifications of what count as similar systems subject to the same laws, and the forms of those laws or approximations to them. For example, that the planets, the earth, and stones falling on the earth are similar types of body and satisfy the same laws, was a discovery made in the seventeenth century which has been maintained through the revolution of modern physics, and so have the approximate forms of these laws within certain empirical limits. Such discoveries have not been affected by subsequent radical conceptual changes in the theory of space and time, or in the understanding of mass and its natural motions, which affect all these bodies alike. Lawlike structures and similarities of nature between physical systems have been maintained and are cumulative. Theoretical interpretations of what the natures of these systems absolutely are, are not. Hence even on such a moderate interpretation of post-empiricism, science must still be said to yield phenomenal or instrumental rather than theoretical knowledge.

III

Post-empiricist analyses of science have placed more emphasis on theories than their empiricist predecessors, but in the end they support rather than undermine the conclusion that natural science is essentially instrumentalist. On the relative value to be given to science as aiming at explanatory theories, and science as the basis for instrumental knowledge, however, Habermas parts company both with Husserl and Heidegger, and with some of the post-empiricists, notably Feyerabend. On the one hand, Feyerabend regards a proliferation of competing imaginative

theories as the mainspring of scientific activity, while reducing pragmatic application to a trivial by-product of this development. In his view, claims for the external truth or objectivity of scientific theory are damaging, since they easily degenerate into dogmatism by circular reinforcement of theory by experience conditioned by theory. Habermas, on the other hand, while agreeing that theory has no claim to objectivity as such, nevertheless maintains the more conservative view that it is just the possibility of technical exploitation that guarantees the value and objectivity of natural science.

It is indeed a main motivation of Habermas's argument to direct attention to the *human interests* served by natural and human science respectively, and to their respective criteria of success and failure, or, as he puts it, to their respective forms of objectivity. In natural science the interest is in exploitable technical control, and the character of natural science as 'objective', 'detached', and 'value-free' is itself a value-characteristic derived from the human decision to develop a form of knowledge which is thus technically exploitable. The sanction of failure is unsuccessful feedback from active prediction and test. Successful feedback depends on the presupposition that the conditions of human nature and its environment remain sufficiently the same: the natural sciences 'grasp reality with regard to technical control that, under specified conditions, is possible everywhere and at all times'.¹ Thus Habermas rejects Marcuse's claim that a new form of society would entail a new science which 'would arrive at essentially different concepts of nature and establish essentially different facts'. On the contrary Habermas believes only that a new *attitude* to science is possible:

The idea of a New Science will not stand up to logical scrutiny any more than that of a New Technology, if indeed science is to retain the meaning of modern science inherently oriented to possible technical control. For this function, as for scientific technical progress in general, there is no more 'humane' substitute.²

In this defence of the objectivity of natural science as technical control, Habermas again rejects the claim that scientific *theory* can describe objective natural reality in favour of an instrumental objectivity guaranteed by control. Marcuse may well be correct in holding that a revolutionary society would

¹ *Knowledge and Human Interests*, p. 195.

² J. Habermas, 'Technology and Science as "Ideology"', *Towards a Rational Society*, trans. J. J. Shapiro, London, 1971, pp. 86, 88.

generate a new conceptual view of nature, as indeed has happened in English society, for example, in the Renaissance, Restoration, Enlightenment, and Industrial periods. However, Habermas's point seems to be that whatever theoretical system is adopted, there will be similar perennial and universal possibilities of instrumental control, and moreover, he holds that a theory of nature going beyond that technical interest to masquerade as a 'pure' ontology is an illusion—possibly a dangerous illusion, since it seems to provide the ideological justification for unbridled engineering both natural and social. In his rejection of realistic interpretations of science as dogmatism or ideology, Habermas is at one with Feyerabend, but it is easy to imagine how Habermas would respond to Feyerabend's rejection of 'mere' technology as an essential ingredient of science. The technologically unconstrained proliferation of theories and ontologies of the natural world recommended by Feyerabend would be ideological opium for the masses alienated and bored by pervasive technology: circuses without even the corresponding bread.

In Habermas's interpretation the forms of objectivity of natural and human science are not transcendental, but are dependent on the value or interest put upon their respective activities by a human community. Whereas the interest of natural science is technical control, requiring skills in the interrogation of nature, the interest of human science is social consensus, mutual communication, and practical effectiveness in social organization, and this requires skills of personal understanding. The guarantee of objectivity in human science is the participation in *dialogue* between investigator and investigated, in which *reciprocal* interaction occurs. The sanction of failure is disturbance of consensus and breakdown of communication. It is clear that the consensus referred to is not the forced consensus of the totalitarian state, since this precludes communication and reciprocal influence. It is rather the consensus produced by partners in dialogue, both of whom may be freely persuaded and changed by the encounter. Neither is it Dilthey's concept of empathy or *verstehen*, in which the investigator claims to enter the mind of his subject and think his thoughts after him, for this presupposes that the investigator's own world (out of which he has artificially abstracted himself) does not impinge on and remains unchanged by the encounter.

The model of dialogue as a form of objectivity is unfamiliar and somewhat shocking to those accustomed to empiricist pre-

suppositions, but it is one of the few viable alternatives to the model of natural science in dealing with the human sciences. An illustration from the historiography of science, which is itself a human science, may indicate how it helps to illuminate certain problems of interpretation. I take an example, which I have developed elsewhere, from a recent debate about the received tradition of historiography of sixteenth- and seventeenth-century science. In an article entitled 'The hermetic tradition in Renaissance science', Frances Yates has expressed an entirely proper desire not to interpret the science of the past 'from the solely forward-looking point of view . . . misinterpreting the old thinkers by picking out from the context of their thought as a whole only what seems to point in the direction of modern developments'.¹ Miss Yates asks for a proper balance between this point of view and a study which takes more account of the historical context of ideas at the time. In a relativist climate it is easy to distort such a balanced approach into a refusal to evaluate the science of the past at all in relation to what is now believed to be true, or to discriminate rationality and empiricism in past thought from such philosophies of nature as hermeticism, alchemy, numerology, and magic. Sceptical conclusions regarding the 'objective' character of scientific knowledge have been held to follow. However, according to the model of historiography as dialogue, such conclusions are illicit. For a historian operating according to this model, neither the anachronistic reconstruction of past science in the light of modern theories and modern evidence, nor the deliberate suppression of these in the attempt to become a 'seventeenth-century man', is satisfactory or indeed possible. What is required is a sympathetic attempt to enter into seventeenth-century thought forms and problems *without* abandonment of the criteria provided by subsequent developments. History of science, like all history, is in principle written anew in every generation. Historical interpretations are irreducibly relative to the historian and his time, but it does not follow that they are *relativist*, if by this is meant that there are *no* external criteria for the evaluation of past science. On the contrary, there are our criteria as they have emerged in the course of history. In our study of the science of

¹ *Art, Science, and History in the Renaissance*, ed. C. S. Singleton, Baltimore, 1968, p. 270. I have discussed this example in 'Hermeticism and Historiography', *Minnesota Studies in the Philosophy of Science*, vol. v, ed. R. Stuewer, Minneapolis, 1970, p. 134.

the past we may not irresponsibly neglect them, for they constitute our side of an objective dialogue.

Whether this model of dialogue turns out under more detailed investigation to be entirely successful or not, the attempt to spell out a methodology of human science shows at least two things. It shows that any assimilation of the methodology of natural to that of human science does not entail that both methodologies are non-objective, since the task of a hermeneutic analysis is precisely to make explicit the conditions of objectivity of the method of dialogue. My example of the interpretation of Renaissance science is itself a brief attempt at just such a hermeneutic analysis. On the other hand, the dialogue model also suggests that complete assimilation of the two kinds of methodology will fail, because nature cannot be regarded as a partner in dialogue. An over-simple dichotomy between natural science, on the one hand, and the objectivity of understanding-in-dialogue on the other is reminiscent of Collingwood's conclusion that non-human subject-matters are not genuine subjects of knowledge or understanding, because not capable of participating in dialogue. This is not Habermas's view, since he places high objective value on technical control, nevertheless it is a tempting interpretation of his view, because in the end he fails to carry through in detail an analysis of what is involved in technical control and to examine what its limitations are. In the concluding part of this lecture I shall raise some questions about this instrumental model of natural science, and suggest that the relation between it and the hermeneutic model is not so much a dichotomy as a continuum.

IV

In discussing natural science Habermas makes frequent use of the concepts of successful prediction, feedback, and self-correction. In effect this is to appeal to a model of natural science as a *learning machine*.¹ It is not difficult to incorporate most of the features of natural science as at present understood into such a model. The presence of feedback loops in a learning machine allows for the circular self-correction of theory by experience and experience by theory that is demanded by interpretation of science as theory-laden. 'Experience' must be regarded in the model as the input or physical stimuli impinging

¹ I have developed this learning model in more detail in 'Duhem, Quine, and a New Empiricism', in *Knowledge and Necessity*, Royal Institute of Philosophy Lectures, vol. iii, London, 1970, p. 191.

upon the machine from its environment. The process of describing experience in inter-subjective language by the scientific community is representable as the coding of the input into machine language according to whatever categories have been programmed into the machine from the current natural language. Doubtless the coding devices will *also* be subject to modification in the light of feedback from successful and unsuccessful learning by the machine of its environment, just as the natural descriptive language of a human learner may be so modified. Thus the physical stimuli themselves need not be directly expressible in any stable language, and it must be a *hypothesis* that they themselves remain sufficiently stable for what is learned by the machine to be applicable and testable on future occasions. In the case of a learning machine in which we can investigate both the mechanism and its environment, we know what some of the conditions of successful learning are. There must be sufficient possibility of detailed *test* to reinforce correct learning; the environment must be sufficiently stable for the self-corrective learning process to *converge*; and there must not be such strong action by the machine on its environment that either it exhibits no convergence, or what it learns is just an artefact of the machine itself. Without such constraints on the environment, feedback mechanisms are liable to go into unstable oscillation. Habermas's objectivity of technical control presupposes that in the subject-matter of natural science, these conditions are satisfied. The last condition is clearly not satisfied in those sciences he describes as hermeneutic, since these are precisely characterized by strong reciprocal interaction between investigator and investigated, or in terms of the model, between machine and environment. In these sciences also the possibility of detailed test and a sufficient stability of environment will sometimes not be present either.

It would be misleading, however, to conclude that the model of learning is quite irrelevant to the human sciences. In the first place, the human sciences are bound to use some of the techniques developed by the natural sciences, and have as good a claim to objectivity in these respects as any natural science. Dating of archaeological findings, and of manuscripts, and reconstruction of historical events from circumstantial evidence are obvious examples. Secondly, in describing a learning machine, nothing need be said about the character of the empirical input, except that it is presumed that assertions are made about it in an inter-subjective language. But this does not

restrict expressions of the input to phenomenalist protocol sentences nor to positivist observation statements. They may, if intersubjectively acceptable to the scientific community, also include sentences ascribing intentions, motives, and emotions to human beings, for these are commonly used descriptively of overt behaviour, and they are subject to test and correction by well-known processes of ordinary observation. Again, the model of the learning machine is flexible enough to take account of some of the 'subjective' elements in both natural and human science, by the device of self-corrective feedback loops. There are cases in the human sciences, just as there are in the natural sciences, where apparent strong interference by the investigator on his subject-matter may itself be allowed for and corrected if a sufficiently comprehensive theory of the relevant processes is available. In arguing for the unpredictable effects of interaction with the subject-matter, hermeneutic philosophers often compare the situation in the human sciences with the uncertainty principle in quantum physics, where the attempt to measure the position of a fundamental particle is said to interfere irreducibly with its momentum, and vice versa. But the analogy is not an apt one, for our information about this kind of interference comes not from direct observation, but from a complex theory of fundamental particles, other aspects of which *are* known by the usual objective learning process. Similarly, although the logical possibility of irreducible interference can be understood in terms of the learning model, it is not enough in itself to prove that particular parts of the human sciences are opaque to the mode of objectivity appropriate to the natural sciences. It is true that the calculations of the learner may be upset by the presence of the anthropologist in the tribe, or the educational theorist in the school, or the TV camera at the civil disturbance, but on the other hand it may sometimes be the case that such interaction can be minimized and allowed for. The possibility of degrees of independence and objectivity should be recognized, and it is the task of a philosopher of the human sciences to spell these out in detail in particular cases.

The conditions of learning and control, then, are sometimes satisfied in the human sciences and sometimes they are not. Conversely, it may be asked whether they are universally satisfied in the natural sciences. Certainly instrumentalists are right in concluding that they cannot be used to guarantee the objectivity of theoretical science, for we have already seen that it is difficult to make sense of a claim that scientific theory

yields objective empirical knowledge unless the succession of theories can be said to be cumulative. Theories are neither cumulative in fact, nor does it seem that such accumulation is a necessary condition for science to be a learning process. If the aim of science is essentially to enable man to learn his way about in his environment, then the only necessary condition for its success is efficiency of learning. As far as we can tell, the learning machine that has been described will continue to learn in a certain kind of stable environment. But we have no idea what is the most efficient method of learning even in such an environment, for the problem of finding theories in terms of which we can learn never has a unique solution. It may be that the quickest learning will take place by frequent and radical changes of theories, or that insertion of some randomness into the machine's selection of best theories and predictions may be advantageous.

Moreover, violation of the conditions of learning themselves is not confined to the human sciences, for the possibility of detailed test, the stability of the environment, and the absence of interaction between machine and environment are not guaranteed by the fact that the subject-matter of natural science is non-human. There are many reasons, ranging from the practical impossibility of detailed test over sufficiently large regions of space and time, to social and moral restraints upon experimentation with the natural environment, which may inhibit efficient working of science conceived as a learning machine. Cosmology and biology cannot be excluded from the domain of natural science, and yet they only imperfectly satisfy the conditions of learning and control. We are left with a problem about the form of objectivity of large areas of natural science that seem to evade both the analysis in terms of learning and the hermeneutic model of personal dialogue

It is possible of course that it must just be accepted with natural piety that there is no form of objectivity appropriate to theoretical science. However, since at least a beginning has been made towards the analysis of an objective hermeneutic method appropriate to the human sciences, and since there are at least some features of the natural sciences that exhibit some features of that method, it is permissible to hope that dichotomy is not the last word. In conclusion I shall briefly suggest two reasons why hermeneutics may yet prove to be more important for natural science than has so far been apparent.

First, the view of nature as merely behaviourally known, and

of man as internally known, implies a separation of man from nature which is itself an ontological belief. It is indeed the converse of that type of naturalism which has sought to totally assimilate man to nature, and which has claimed, no doubt illicitly, the support of natural science itself. But neither naturalism nor its converse seems to be justified as a consequence of *natural science*. Justification of either view would have to be sought in terms of a method adequate also for the human sciences, and if the dialogue model is taken as that method, it might at least suggest that the understanding of man implies an understanding of related biological nature, and conversely. It is impossible in studying theories of evolution, ecology, or genetics, to separate a mode of knowledge relating to technical control from a mode relating to the self-understanding of man. This is not just to assert that human values will be involved in *applications* of these theories, though that is true too; it is also, and more centrally for the present discussion, to assert that the very categories of these theories, such as functionality, selection, survival, are infected by man's view of himself.

Secondly, as is suggested by these examples, and has been abundantly demonstrated in the history of all natural sciences, theories have always been expressive of the myth or metaphysics of a society, and have therefore been part of the internal communication system of that society. Society interprets itself to itself partly by means of its view of nature. Even to deny the propriety or relevance of this is to hold a view of man's relation to nature, namely their total separability. This is a sense in which nature does indeed partake in the dialogue of man with man, and can itself be said to be informed by human meanings and subject in its theoretical aspects to hermeneutic methodology.