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Experiment and Experience: A Critique of Modern Scientific Knowing*

It is commonplace these days to attempt to render all intellectual activities scientific. This adjective is almost synonymous with reasonable, rigorous, systematic and desirable. The classical ideal of seeking the true, the beautiful and the good amounts nowadays, at least in the universities, to being scientfic. The force of the mystique and metaphysics of science becomes particularly apparent in philosophical, psychological and religious studies where the scientific stick has been widely used to drive out a great deal of sensitive feeling and imaginative thought. One could use the etymological meaning of the word 'science' and then wonder how anyone could question the obvious desirability of 'knowledge'. But to do this is to insist on using ancient meanings which are related to the present intellectual opinion by very thin threads indeed. Presumably, when people talk about the scientific study of something, they have an explicit or implicit model of the modern natural sciences in mind. It is obvious that these sciences operate from many fundamental assumptions about the nature of man, truth and reality; most of these metaphysical presuppositions have been incorporated into the contemporary social sciences and the humanities to their detriment. Here I wish to point out some of these assumptions and to discuss their validity and limitations; what is proposed is a radical re-examination and revaluation of scientific knowledge.

My intention is not to suggest that the study of man is fundamentally different from the study of nature and therefore should be based on different principles. On the contrary, I hope to show that this sundering of man and nature is built right into the presuppositions of the modern sciences, and is entirely questionable. If one is persuaded that scientific studies have not yielded any essential understanding of

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man, one need not be driven to the belief in the disunity of man and nature, and consequently of knowledge. It is possible that the procedures and methods of the natural sciences are no more impeccable and beyond question in studying nature than they are in studying man. It may be that in the latter case, some of the metaphysical restrictions and limitations of science become more apparent. In general, those who attempt to understand man seem either willing to leave nature to the scientists, as if man had nothing to do with nature, or to utilize scientific procedures which inevitably lead to the impoverishment of man, as of nature. If for us science-nurtured moderns, cosmology has become, as a matter of course, a branch of physics, then it should come as no surprise that man is merely an aggregate of material particles. The tragedy of the post-renaissance intellectual life is that there are very few individuals who have included nature, man and divinity in a unified continuum of investigation based not only on speculative concepts but also on experience and perceptions.[1] This, I have come to believe, is the result of an inner fragmentation in which man and nature are separated from each other, as are poetry and physics. This fragmentation is embodied in the very structure of the modern sciences.

The central core of any theory of knowledge, including science, is constituted by the triad of the knower, reality and the connection between them. Different theories and practices emphasize different aspects of man (reason, feeling, sensation) or of reality (quantity, quality, mechanism, purpose) or of the connection between these two (repeatability, uniqueness, inter-subjectivity, involvement). No great theory wholly ignores any one of these several aspects; difference lies largely in the emphasis and in the underlying faith about what is primary and irreducible, in terms of which everything else must be explained. (An example of this is the scientific faith that quantity is somehow basic and that all qualities whatsoever can and must be explained in quantitative terms.) Appreciable satisfaction and success afforded by a theory of knowledge – the measure of which depends on our valuation of its purpose and accomplishments – can easily lead to its being established as *the* way to truth, making doubters into heretics.

Perhaps the most important innovation of the great scientific revolution of the sixteenth and seventeenth centuries was a restructuring of the triad of knowledge, with its insistence that empirical observations can and do lead to truth which cannot be approached by

reasoning alone. Having been conditioned by centuries of scientific success, our very notion of rationality is now based on the model of scientific procedures; it is now difficult for us to realize that whatever the scientific revolution was about it was not universally considered a triumph of reason. Whitehead has correctly observed that "Science has never shaken off the impress of its origin in the historical revolt of the late Renaissance. It has remained predominantly an anti-rationalistic movement, based on a naive faith."[2] It was clearly a necessary reaction to the rationalistic extravagance of the scholastics. However, perhaps like all revolutions, the scientific revolution was based on simplistic assumptions. It swept away much in earlier thought that was useful and wise and in harmony with reality; also by accepting a limited criterion of truth, it guaranteed an inner fragmentation of man. In spite of later considerable upheavals within scientific theories, the basic attitudes and presuppositions of the modern sciences remain essentially the same as emerged during the revolution; it is from there that we derive most of our scientific outlook, even in the humanities.

On a large historical scale, the relatively recent appearance of the scientific attitude should itself be a reminder that humanity can exist without it; many presently widespread signs, particularly among the young, seem to suggest that unless the metaphysical basis of sciences is understood and broadened to include much that has been arbitrarily excluded, we shall be soon ushered into the post-scientific age. And this enlargement of the scientific base is likely to come about largely from within the scientific community. We cannot exclude the possibility of some useful contribution from the outside, but in general most non-scientists are awed and overwhelmed by science into wishful acquiescence or frightened hostility. What science needs is neither worship nor rejection, but critical self-understanding and change. Need for this has always been there; now it has become urgent. To the extent that science is an avenue to Truth – yes, with a capital T, something which most scientists tacitly believe, however unsophisticated it may appear in the modern age – scientists cannot but be interested in the kind of knowledge they produce. It was a master-scientist, Albert Einstein, who said:[3]

> How does a normally talented research scientist come to concern himself with the theory of knowledge? Is there not more valuable work to be done in his field? I hear this from many of my professional colleagues; or rather, I sense in the case of many more of them that this is what they feel.

> I cannot share this opinion. When I think of the ablest students whom I have encountered in teaching – i.e., those who distinguish themselves by their independence of judgement, and not only by mere agility – I find that they had a lively concern for the theory of knowledge. They liked to start discussions concerning the aims and methods of the sciences, and showed unequivocally by the obstinacy with which they defended their views that this subject seemed important to them.
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> This is really not astonishing. For when I turn to science not for some superficial reason such as money-making or ambition, and also not (or at least exclusively) for the pleasure of the sport, the delights of brain-athletics, then the following questions must burningly interest me as a disciple of this science: What goal will and can be reached by the science to which I am dedicating myself? To what extent are its general results 'true?' What is essential, and what is based only on the accidents of development?...
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> Concepts which have proved useful for ordering things easily assume so great an authority over us, that we forget their terrestial origin and accept them as unalterable facts. They then become labelled as 'conceptual necessities,' *'a priori* situations,' etc. The road of scientific progress is frequently blocked for long periods by such errors. It is therefore not just an idle game to exercise our ability to analyse familiar concepts, and to demonstrate the conditions on which their justification and usefulness depend, and the way in which these developed, little by little...

Experiment and Experience

One of the most important reasons for the avowed success of the natural sciences in investigating nature has been a particular wedding of a restricted notion of man, namely that he is essentially a rational cognizer, and a limited class of experience, namely experiment. It was the coming together of these two, reason and experiment, in a mutually regenerative role that characterized the scientific revolution and all subsequent science. In the formation of the scientific attitude to nature experiments play a large role, for they are what ultimately constitute the scientists' handles on reality. What I am including under experiment is anything connecting scientific perceptions and conceptions; in other words, all the means and procedures for collecting scientific data, including observations, tests, surveys. The central place of experiment in the sciences is beyond question. No scientist will question the statement of Richard Feynmann on the first page of a fairly recent and highly successful physics textbook that "The principle of science, the definition, almost, is the following: *The test of all knowledge is experiment.* Experiment is the *sole judge* of scientific 'truth'."[4]

It is important to distinguish between experiment and experience, although these two terms are often used interchangeably in scientific

and philosophical writings. There are significant differences in their connotations and applications in different endeavours. The sciences by no means have a monopoly on observational and empirical procedures; the vast realms of aesthetics and spirituality are nothing if not empirical. In the sciences, it is ultimately the external experiment which is the arbiter of the truth of one theory or hypothesis against another. In the sphere of spiritual becoming, on the other hand, the central focus is the inner experience of the aspirant. Without the corresponding experimental data, scientific speculation tends to become sterile and fruitless; similarly, without reference to experience, all theological talk remains empty – full of comfort and hope perhaps, but not charged with real understanding. To make bedfellows of Francis Bacon and St. Paul, one could say that neither scientific knowledge nor spiritual understanding is a matter of talk; in either case it is a matter of power. The nature of this power depends on where the criteria of truth and falsity are centred – in experiment or experience. Both mediate between human beings and reality but differently, and with quite divergent consequences.

The word experience is derived from the Latin word *experientia,* and experiment from the Latin *experimentum.* Their etymology reveals some interesting features. Both *experientia* and *experimentum* are derived from *experiens,* the present participle of *experiri,* which means to try thoroughly. *Experiri* is a conjunction of the prefix *ex,* meaning thoroughly, and *periri,* which means to go through or to try and to risk. This latter *periri* is also related with the English word peril; thus peril is a trial which one passes through. The word fare, meaning travel, as in the word wayfarer, also derives from the same root. It seems that to experience something is to pass through it thoroughly, involving some personal risk; it is to participate in and partake of personally, to undergo. The knowledge obtained by such a procedure is what we would call understanding or comprehension. Experience includes perceptions, feelings, sensings. The word experiment, on the other hand, although derived from the same root, has in the last three hundred years diverged in its implications from the word experience. One set of meanings of the verb experiment used to be: to have experience of; to experience; to feel, suffer. These meanings, however, are obsolete, and it appears that the word experiment has not been used in these senses since early in the eighteenth century. The verb

experiment is used these days as an intransitive verb, and no longer transitively like experience. I can experience a flower, but I can only experiment with or on it. To experiment now is primarily to conduct an experiment which is a test made to demonstrate a known truth, to examine the validity of a hypothesis, or to determine the efficacy of something previously untried. The knowledge obtained by these procedures is what constitutes scientific knowledge.[5] Clearly, experimental sciences are not experiental in character; in fact, they are determinedly contra-experiential in their attitudes, implications and tendencies.

It seems that Galieo ,was the first modern scientist clearly to differentiate between these two concepts; before him *experientia* and *experimentum* were more or less indiscriminately used. He says in his *De Motu:* "Those things which we have demonstrated...must be understood as referring to moving bodies which are free from all external resistance. but since it is perhaps impossible to find such bodies in the material world, anyone performing an *experiment* concerning these things should not be surprised if the (resulting) *experience* disappoints, and that a large sphere cannot be moved by a minimal force, even if in a horizontal plane."[6]

Presumably, experience for Galileo refers to what one actually sees, and experiment is the procedure of testing a hypothesis. His hypothesis pertains to a conjectured ideal and rational world in which one can imagine ideal bodies free from all external resistance. Because of their ideal and rational nature, they can be reasoned about mathematically; inferences of this reasoning process is what he subjects to experimental test. Whatever the nature of this abstract theoretical construction may be, the testing procedure does not depend on experience in the sense of personal, existential involvement. Even a cursory reading of the *Dialogue Concerning the Two Chief World Systems* written by Galileo, the first major modern natural philosopher, is enough to persuade one that the experimental method of knowledge is empirical only in a special and limited sense, and that it is certainly not experiental. What is apprehended by us directly with our mind, feelings and senses is not what we depend on for true scientific knowledge. Feelings and senses are particularly suspect. Galileo commended Copernicus and his followers who "have through sheer force of intellect done such violence to their own senses as to prefer what reason told them over that which

sensible experience plainly showed them to the contrary."[7] It would take too long to establish that such an attitude towards feelings and the senses is a hallmark of the scientific revolution; however, on this attitude depends the all-important distinction between primary and secondary qualities – crucial to the development of Physics – and the scientific notion of objectivity. Exclusion of the immediacy of perceptions and feelings is central to the scientific procedure; what one does in scientific experiments is to measure, not experience, certain qualities of things. This measuring can be done indirectly without the scientist seeing or feeling what he is measuring, and indeed without his being involved at all in the actual event of observing and recording – which can, in principle, always be done automatically. A successful experimenter can arrange matters so that he does not have to be present in the laboratory when data are collected about the scattering of electrons or the overcrowding of rats or the contraction of the uterus in childbirth. Personal equation is something that a scientist must assiduously attempt to eliminate. Where he needs to come in is in interpreting and manipulating data, imagining new hypotheses, and devising new experiments. Obviously, none of these activities is easy or trivial; they call for a great deal of cleverness, ingenuity and sometimes genius. Nevertheless, the fact remains that for the observations themselves, which provide the only direct scientific contact with reality, no human intervention is strictly speaking necessary; in any case, certainly not of the feelings and most of the senses.

Now, what kind of data can be gathered by ignoring so much of what makes us human? What is this reality that is revealed by observations which can be made by properly programmed automatons? What sort of theories can be tested or satisfied with such impoverished data? What significance can be claimed by knowledge based on such determinedly partial perceptions? These questions call for a detailed and careful investigation, particularly these days when most academics have raised science and scientific method to an intellectual orthodoxy. Obviously, this is a long-term project. All I hope to do here is to open this line of inquiry, and to suggest that perhaps we have been dazzled by the magical successes of science and technology into accepting unwarranted metaphysical assumptions about the nature of reality and of man, and their relationship with each other. These assumptions are partial and they necessarily lead to a further fragmentation of our sensibilities,

resulting in an attitude of inner violence towards the object of investigation. The procedures based on them are quite unlikely to lead to a sympathetic understanding of either nature or man. In particular, what is higher, within us or above us, cannot even be approached by the divided self that is an inevitable consequence of the scientific mentality.

Clearly, there are many metaphysical assumptions underlying the scientific enterprise. Most of these assumptions are now widely taken to be valid in the humanities also, indicating the wholesale capitulation of the intellectual community and the pervasive influence of science. This influence asserts itself through something labelled *the scientific method* which most non-scientific academic disciplines are especially anxious to get hold of. It is difficult to find examples in intellectual history where creative thinking proceeded from methodology to practice. Even Descartes, who made so much of method, wrote his *Discourse on Method* after the scientific essays to which it forms a preface, and not before. It is only in the contemporary social sciences that one finds so much faith in the efficacy of verbalized methodology. Among the natural sciences it is a rare department which offers a course on method. The method simply is, as I think was expressed by P.W. Bridgman, to do one's damnedest best with no holds barred. Nevertheless, there are basic assumptions underlying the scientific procedures; these assumptions are handed down by tradition and are in general acquired by students unselfconsciously.

Objectivity

The locus of scientific objectivity is not in the object under investigation, but in the subjects investigating the object. What we call objectivity in the sciences is inter-subjectivity; we would say that we have come to an objective description of something if most of the competent investigators – who are such precisely because they share the same assumptions and procedures – agree with each other about this description. Whether the description actually describes the object is another matter; we do not even know how we might determine this unless we were to allow the possibility that the object knows itself and reveals itself. Such a concession of consciousness and intention to any object runs directly counter to the basic scientific conception of the cosmos as a huge machine in which, ultimately, everything has to be explained in terms of (unconscious and purposeless) matter in motion

(without meaning). The object is assumed to be controlled wholly from the outside and is defined exclusively in terms of its external characteristics and relations.[8] This denial of any inner reality, however rudimentary, to a stone or a tree or an ape leads, with rigorous logical necessity, to the denial of such a reality – consisting of consciousness, purpose, intention and conscience – to man.[9] In the absence of self-knowledge and concurrence by the object, which could be a tree, a man or a culture, all we have are our inter-subjective conventions concerning procedures and criteria for determining the truth or falsity of our statements about the object. Niels Bohr was right in saying, in his argument with Einstein, that "It is wrong to think that the task of Physics is to find out how nature is. Physics concerns what we can say about nature."[10] The conventions we adopt depend on their effectiveness in pursuing what we take to be the purpose and aim of the knowledge we gather. I will return to this point later; for the present, I wish to draw attention to the convention and subjectivity, albeit a general one, inherent in the much acclaimed scientific objectivity.

There is another, closely related, point to be made: at the root of this necessity of substituting inter-subjective agreement for objectivity is the assumption that the knowing subject and the object of knowledge are inalienably distinct and separable from each other. It is an implicit assumption of the scientific revolution that man the cognizer is not a part of the nature he investigates; he is over and against nature, or in any case separate from it. This becomes more apparent when we do not consider nature in any large sense but confine our attention to a specific object of investigation, such as a molecule, a frog or a star. Moreover, this separation is ensured by the experimental procedure. The assumption of the separability of the subject and the object, which is a corollary of the presupposition that our self or identity is essentially nuclear and localized in space-time, has a much longer history and wider base than modern science; one does not question it lightly.[11] Nevertheless, it remains a fact that many artists, poets, mystics and others have reported that in their deeper experiences, the subject-object distinction is not as obvious and meaningful as it usually appears to our ordinary consciousness. There is a qualitative change from the relationship of separateness to that of oneness which, whenever it occurs, is almost always claimed, by the person who experiences it, to be the result of perceptions which are clearer and

more heightened than usual. Some would even say that taking the appearance of the knower-known dichotomy for reality is the very root of ignorance, and that any observation in which the observer is distinct from what is observed is incomplete. The suggestion is not that there is no distinction between the subject and the object at all, and that an undifferentiated chaos prevails. It is, rather, that whatever is essential to the object – a tree, a poem, or a person – is not comprehended as long as one stands completely apart from it, without participating in it; concerned only with the characteristics external to it. In any case, the rigidity of the object-subject distinction may not be immune to doubt, at least in some circumstances. If one gathered knowledge with a different purpose in view, one might see things differently; and the obviousness of our total separation from each other and the objects around us might well be like the obviousness of the sun's motion around the earth.

Abstraction

Underlying the perceived reality in science is posited an abstract and purely rational construct. What is experienced is then called appearance, while the mental construct is labelled reality. The scientific pursuit, then, is to speculate about the imagined reality and to put these speculations to the experimental test, involving only certain limited perceptions. The so-called objective reality of scientific concern is in fact a conjecture – perhaps one of the many which may be possible – of subjective reason. However, and this is where the importance and glory of science lie, these subjective projections are confirmed or falsified by inter-subjective experimental procedures. Nevertheless, the testing procedures are not wholly independent of the theoretical framework, and what observations are taken to be a confirmation of a given conjecture is increasingly, as scientific experiments become more and more elaborate, a matter of interpretation. It is not possible to make a scientific observation without a prior theoretical system, as has been emphasized by Karl Popper.[1 2] In science, any theory is better than no theory. In order to get going, scientists are happy to have partial, incomplete, or wrong, theories rather than wait for a correct one; until a new theory is available, the old one is not abandoned however many problems it may have. Theorizing is fundamental to scientific activity; what we subject to

experimental observations is not nature, but our conjectures about nature. The scientific revolution marks a shift not only from experience to experiment but also from seeking certain truth to theorizing about probable truths. In science, reality is theory.

This is true for all the sciences, not only for physics. Every experimental science is first of all a theoretical science, although the theoretical system may be more or less explicit. Here is an example from Sigmund Freud: "Our purpose is not merely to describe and classify phenomena, but to conceive them as brought about by the play of forces in the mind, as expressions of tendencies striving towards a goal, which work together or against one another. In the conception, the trends we merely infer are more prominent than the phenomena we perceive."[13]

In the experiential approach to reality, as in some artistic and spiritual disciplines, the attempt is not to abandon the real phenomena that we perceive, by some kind of leap of reason, but to widen and sharpen our perceptions, and to bring all our faculties to bear on what we experience. Theory is important here too, for obviously the reason which calculates and theorizes is also a perceiving faculty; but experience is more than theory, its significant features are immediacy, concreteness and directness of perception. The point of the theory is to help a person experience directly and fully. The point of experiment, on the other hand, is to lead to theory or to decide between one theory and another. In science, experiment has no meaning without theory; but in life, theory has no sense without experience.[14] What we seek in science, via experiment, is abstract explanation of phenomena; whereas what we might seek in life, aided by any theory, is concrete and experiential understanding of what is.

Quantity

One important feature of any scientific description is that it attempts to be quantitative. Most of the major scientists contributing to the scientific revolution appear to have been self-consciously opposed to the earlier, more qualitative, science. According to Galileo, "Philosophy is written in this grand book, the universe, which stands continually open to our gaze. But the book cannot be understood unless one first learns to comprehend the language and read the letters in which it is composed. It is written in the language of mathematics, and its

characters are triangles, circles, and other geometric figures without which it is humanly impossible to understand a single word of it; without these, one wanders about in a dark labyrinth."[15]

Similar enunciations can be found in Kepler, Boyle, and Newton. It is not at all obvious, or even true, that to be mathematical means to be quantitative. Even the most apparently quantitative of all mathematical entities, namely numbers, cannot be considered without quality. Unity, duality and trinity have qualitative aspects which are not exhausted by numerical manipulations. Nevertheless, in general, mathematization in science has meant quantification. According to the fathers of modern science, quantity is the fundamental feature of things, prior to other categories; in the realm of knowledge, quantity is the sole feature of reality. "Just as the eye was made to see colours, and the ear to hear sounds," wrote Kepler, "so the human mind was made to understand, not whatever you please, but quantity."[16]

Qualities, except insofar as they can be quantified, do not belong to what is real, and cannot be avenues to truth. There was a great leap forward for exact science when Isaac Newton in his *Principia* defined motion in terms of quantity of motion – without regard to whether this motion was part of a sacred dance or a funeral march – and when he defined matter in terms of quantity of matter – without any consideration of where that matter belonged and what function it served. Unlike earlier natural philosophers, modern scientists do not consider qualitative aspects like place and function as being relevant to a precise definition of matter, motion and other entities. One cannot escape the impression that the prevalent general levelling down of quality and the pernicious reign of quantity – which has been passionately described by, among others, Ortega y Gasset in his *Revolt of the Masses* – is intrinsically connected with the scientific assumption that reality is primarily quantitative, and can be approached mainly by quantitative procedures. Whatever functions painting, music and dance may serve, when it comes to the serious business of truth and knowledge, as understood by modern natural philosophers, they are essentially frivolous. This is the seed of fragmentation of our sensibilities. Our gods of reason and truth admit physics in their temples, but not poetry and painting. The wisdom of such gods is questionable; it may well be, as William Blake said, that "Reason and Newton they are quite two things."

Perceptions

The scientific assumption about man is that he is essentially a rational cognizer, and that everything else about him is secondary and capable of explanation in terms of his basic rational nature. This view of man as primarily a passionless, disembodied mind, which would be recognized as the rigorously intellectual point of view, is shared by all who claim to be scientific in their professional work, from Descartes to the modern analytical philosophers. Other faculties of man – his feelings and sensations – are not considered capable of either producing or receiving real knowledge. Those aspects of reality which correspond to the non-rational faculties of perception – aspects such as colour, smell, taste, beauty, purpose – are either completely ignored or are relegated to a secondary status. It is no doubt true that, as we are, our ordinary sensory and emotional experiences are limited and subjective. In science, an attempt is made to minimize the dependence on such perceptions by agreeing that the corresponding aspects of reality not be considered as objectively real, and by dealing with only those aspects where rational constructs can be applied. (It is entirely reasonable, for example, to think about and to measure the mass and charge of an electron – though neither property can be directly sensed – but it is faintly ludicrous to ask about the taste or colour of it. If one were to ask about its purpose, one would be outside the scientific arena entirely.)

On the other hand, we might attempt to cleanse and deepen our perceptions so that we could see those aspects of reality which we ordinarily miss because we are oblivious to them, being preoccupied with our personal, subjective emotional existence – with our fears and hopes, desires and wishes, likes and dislikes. This subjective preoccupation is the chief characteristic of the general state in which we ordinarily live. However, it is possible for man to move in a clearer, more objective realm of feeling; and then to engage this important aspect of himself in perception, rather than to systematically eliminate it out of a suspicion, by itself well-justified, that our ordinary emotions are largely subjective and unreliable guides to truth.

Here, indeed, is an instance of throwing the baby out with the bath water. It has been bemoaned often enough that scientific knowledge does not address itself to the issues of human purpose and aspiration, or the meaning of man's existence. All these concerns reside in feeling

when it is a little freed from exclusively subjective preoccupations. Yet feeling is the one aspect of our wholeness rigorously ignored in the scientific methodology. It seems to have largely escaped modern epistemologists that feelings, when developed and trained, can yield objective knowledge. On the other hand, it is precisely through feelings, integrated with other faculties, that we can approach objective understanding, for feeling is the faculty of relation with any object; it is the reconciling aspect of man. Reason, on the other hand, differentiates, making distinctions and comparisons. By comparing different subjective measurements, it can lead to inter-subjective knowledge, not necessarily agreed to by the object. If we make a fetish of detached rationality, we unnecessarily impoverish our perceptions.

Control

Another basic assumption is implicit in the procedures and purpose of modern science, as distinct from that of ancient or medieval sciences. What modern scientists aim at is the prediction, control and manipulation of what they investigate. Here is a statement by a Yale biophysicist about his work; he is discussing the question of the adequacy of the laws of physics in explaining the behaviour of living organisms: "The biophysicist approaches this problem by assuming that the laws of physics do work in the living cell and by putting together what information he has to try to predict how a given system should work. If the prediction proves correct, then presumably the present physical laws are adequate. If not, then perhaps new things will have to be found." After noting some of the difficulties in investigating these matters, he adds that, "Eventually, of course, we'll surmount these obstacles, and then we'll know whether the cold laws of inanimate nature are enough to explain the nature of the living cell. If such should be the case, it will give us a control over the living cell which we have never had before."[17] Notice how easily words like prediction and control enter here as a matter of course. This is what doing means, the doing which is so intimately connected with scientific knowing – a point which has been well appreciated by the pragmatists, and above all by John Dewey.[18]

One question that immediately arises concerns the reductionism involved in studying living organisms, particularly human beings, with the laws of physics. Yet what is more pertinent here is something

different; namely, the deep-rooted anthropocentric view of modern science, a view which, in the light of its own discoveries, could be considered nothing but absurd. It is certainly questionable that man's relationship to the entire universe – in which we occupy a small place, on an ordinary planet of a third-rate and peripheral sun in an average galaxy – should be primarily one of control. The spatial shift in the centre of the cosmos, brought about by the Copernican revolution, appears to have been accompanied by a reverse epistemological shift towards a collectivised egocentricity in which man becomes the measure and end of all things.

What does this insistence on control and manipulation amount to in knowing something? Does it not guarantee that we cannot know, by these methods, anything that is higher than us, anything subtler or more intelligent than us, if such a thing, or being, or force is not susceptible to our control? If scientists speak of lacking evidence of anything higher than man, that is to be expected, for their procedures specifically preclude the possibility of such evidence.

It can be argued that even though the scientific approach might not be suitable for knowing anything higher than man it is nevertheless suitable for investigating nature. Even if this were the case, the arbitrary assumption clearly remains that nature is lower than man, that it neither encompasses us nor has any larger purposes which humanity also serves.[19] The tools used by science ensure the self-fulfillment of this assumption. This sundering of nature and man is very much a contribution of the scientific revolution, in particular of Descartes. It then becomes a matter of course that man should want to conquer nature; and a terminology of combat enters the scientific ethos without notice or comment.

Before proceeding further, let me illustrate some of what I have said so far by quoting from Immanuel Kant, who was both a scientist and a philosopher, and who anticipated much of what later philosophers have remarked about the scientific method and the nature of experimentation:

> When Galileo let balls of a particular weight, which he had determined himself, roll down an inclined plane, or Torricelli made the air carry a weight, which he had previously determined to be equal to that of a definite volume of water; or when, in later times. Stahl changed metal into lime, and lime again into metals, by withdrawing and restoring something, a new light

> flashed on all students of nature. They comprehended that *reason has insight into that only which she produces on her own plan* and that she must move forward with the principles of her judgements, according to fixed laws, and *compel nature to answer her questions, but not let herself be led by nature,* as it were in leading strings, because otherwise accidental observations, made on no previously fixed plan will never converge towards a necessary law, which is the only King that reason seeks and requires. Reason, holding in one hand its principles, according to which concordant phenomena alone can be admitted as laws of nature, and in the other hand the experiment, which it has devised according to those principles, must approach nature, in order to be taught by it: *but not in the character of a pupil,* who agrees to everything the master likes, *but as an appointed judge, who compels the witness to answer the questions which he himself proposes.*[20]

Scientific knowledge acquired by the imposition of this metaphysical straight-jacket on reality is like a confession obtained from an adversary under duress. Whosoever objects to such procedures is suspected by the contemporary intellectual orthodoxy of sabotage or defection to the enemy camp of hopeless romanticism or irrational mysticism – opposed to reason and progress. Nevertheless, it is important to appreciate the magical spell of science for what it is. It would appear that whatever we can study from the scientific point of view of manipulation and control – whether it is universe, man or divinity – has been produced, at least partly, according to our plans; it is something that can be compelled by us to yield answers to our questions. It cannot be higher than us; for that which is higher – in nature no less than in man – can neither be coerced nor violated by us. We can prepare ourselves for it and wait, actively making an effort of attention, observing without violence.[21]

It should be clear that any vision of reality or any view of human knowledge that, in its very principles, accepts distinct fragmentation into compartments – such as the aesthetic, the scientific, the spiritual – is, to say the least, incomplete and productive of inner conflict and disharmony, which in its turn results in external aggression and violence. The primary task of a sound theory of knowledge is to work towards principles and procedures which do not ignore any faculty of perception nor any aspect of experience, thus maintaining the integrity and the wholeness of the investigators. Only then is it possible to ensure that the object of investigation will be understood as it is, rather than in conformity with a distorted sense of control and manipulation. There is no reason why we must accept Kant's opinion that we behave like an appointed judge, compelling the witness to answer our questions, any

more than a pupil who is passive and subservient. We could, for example, approach reality sympathetically, neither aggressive nor passive, attempting to understand with the attention of all our faculties instead of a coercive reasoning.

It appears, then, that the first principle of a theory of knowledge ought to be concerned not so much with the question of how we *know* something as with the concern how we are to *be* with respect to it. The primary question is of our being rather than knowing. If our assumptions and methods do not violate the integrity and wholeness of our own being, only then is it possible for us to understand something real about any object, without violence and distortion.

In mentioning such a first principle, we have moved very far from the concerns and preoccupations of the metaphysics of science and of scientific philosophy. No major western philosopher since Thomas Aquinas – with the possible exception of the Cambridge Platonists in the seventeenth century – has considered the question of *being* as germane to the question of *knowing*. This is also the period of the rise and hegemony of the scientific mentality which, both in theory and practice, diminishes all other faculties and aspects of man other than his reasoning ability, and systematically ignores much of what makes us whole. Taking external experiment – devised according to this ignorance – to be the sole criterion of knowledge institutionalizes a fragmentation of our sensibilities. Such knowledge cannot but work counter to the enlarging of being or consciousness in man. Even in the disciplines where one might imagine that such questions have an obvious place, the scientific procedures prevail, giving them a narrowly rational turn. Thus, to the extent that philosophy and theology become scientific, God is reduced to a mental construct: either a hypothesis for deduction or an inference from induction; in either case a construct for or against which one can have proofs or arguments, but of which one can have no experience. Theology thus becomes a rational profession dealing with metaphysical systems, rather than a psycho-spiritual path for the transformation of the being of man.

Experimental knowing, owing to the estrangement of the knower, is sundered from being, and is concerned with a low order of doing, involving control and manipulation. Experiential knowing, which now appears to be a different kind of knowledge – akin to gnosis, wisdom or understanding – involves all aspects of man and is intimately

connected with his being. Some of the ancients understood this, and Parmenides went to the extent of saying that "to be and to know are one and the same."[22] This concern for being, whatever else it involves, is a concern for the wholeness and integration of man, calling for a harmonization of the various faculties of perception. Only then can our different parts come together and act as a unified whole, enabling us to perceive openly, fully and directly. This inner harmony of the soul is what Plato considered necessary for just and beautiful action; and he regarded the knowledge leading to such harmony as wisdom.[23] Clearly, no such inner synthesis and composure is possible without including our feeling perceptions. Science by systematically ignoring this side of man, has created a basic opposition to mysticism, which Goethe rightly called the dialectic of feeling.

A philosophy which loses sight of any one of the three major concerns and necessities of man – namely of being knowing and doing – is bound to be partial and self-defeating. By ignoring any one of these, we achieve knowledgeable action without compassion, or compassionate action without knowledge, or else wisdom without action. The desirable alternative to the fragmentation and aggressiveness of science is not well-intentioned impotence or mystical passivity, but rather robust and integrated activity, without violence and without disassociation of our sensibilities. Providing a sound critical basis for such theory and practice is important and urgent; otherwise irrational romanticism, for or against science, holds sway. Scientfic commitment and sensibility of wholeness are not inexorably opposed to each other; however, reconciliation is possible only when the partial finds its place in the whole, and reason its place in being. Only when we proceed from an inner reconciliation can we hope to understand nature – its workings and its purposes – and cooperate in serving what is higher. Such knowledge can speak to our deepest aspirations and our search for meaning while revealing the beauty and mystery all around us.

Some of the ideas in this essay arose in response to various remarks made by Professors Eugene P. Wigner, John A. Wheeler, Thomas S. Kuhn and Walter Kaufman in seminars or private discussions when I was a Visiting Fellow at Princeton University in the Program for History and Philosophy of Science, on a Canada Council Post-Doctoral Fellowship in Philosophy in 1968-69. Much of it was written during 1973-74 at ColumbiaUniversity where I was a Visiting Scholar in

Religion on a Fellowship for Cross-Disciplinary Studies awarded by the Society for Religion in Higher Education. An earlier version of this essay was presented, in a considerably different form, at a meeting in Toronto of the Canadian Society for the Study of Relgion in May, 1974. I have had the benefit of discussions with Professor W. Nicholls of the University of British Columbia, Mr. Arvind Sharma of Harvard University, and Professors Wilfred Cantwell Smith, A. Hilary Armstrong and Robert H. March of Dalhousie University. My friend Robert L. McWhinney was very helpful in his editorial advice. However, none of these gentlemen is necessarily in agreement with what I have written above. A research grant from Dalhousie University is gratefully acknowledged.

Footnotes

1. Perhaps the single well-known exception is Goethe. His criticism of Newtonian science, unlike that of Blake or Wordsworth, has the merit of being reasoned and consistent, besides having a detailed theory and example of doing science with alternative and more unifying assumptions. However, his influence in the scientific circles has been negligible. (Newton's own theology and alchemy are fascinating but show little continuity with his science.)
2. A.N. Whitehead, *Science and the Modern World*, Chpt. 1.
3. Quoted in Gerald Holton, *Thematic Origins of Scientific Thought* (Cambridge, Harvard University Press, 1973), p..
4. *The Feynmann Lectures in Physics*, Vol. 1.
5. One can, no doubt, conduct experiments with others' experiences or with one's own; and thus obtain (unexperienced) scientific knowledge about the characteristics, causes and effects of a given type of experience. An example of this sort of experimentation is the introduction of measured doses of hallucinogenic drugs in a given subject, recording the accompanying experiences and making inferences. Also, one can, of course, have an experience of conducting experiments, as most scientists do.
6. *Opere*, ed. Naz. I, 300-301.
7. *Dialogue Concerning the Two Chief World Systems – Ptolemaic and Copernican;* Third Day; trans. Stillman Drake.
8. The evolution of a species, for example, has to be explained in terms of environmental adaption, or some other mechanism external to the species, rather than, say, as the evolutionary thrust of consciousness needing more complex organisms for manifestation.
9. Thus, any notion of the *Spirit* which is 'pure consciousness' or *soul* which bears 'will' and 'conscience' is, from a scientific point of view, unacceptable *ab initio*. One recourse from this materialization of man is to posit a sharp discontinuity between man, specifically his mind, from the rest of nature. This is the path which Descartes chose and many now follow. Such a sharp division appears to be, both from the philosophic and the scientific point of view, quite unnatural. If we proceed on the basis of a humanization (or spiritualization) of matter – as is being suggested here – we should expect different kinds of scientific theories.
10. Ruth Moore, *Neils Bohr* (New York, Alfred A. Knopf, 1966), p.406.
11. This may well be the area of the greatest divergence between a rational and humanistic metaphysics on the one side and a mystical-spiritual metaphysics on the other. For the former, what is essential about a person is his particularity and uniqueness, whereas for the latter these are secondary manifestations of a transpersonal reality. Since the somewhat unfortunate alliance of Descartes and Locke, the Western psychology has been basically atomistic, believing that a human being is primarily an isolated ego afloat in a sea of interactions, undulating in reaction to purposeless external forces.

12. See his *Conjectures and Refutations.*
13. S. Freud, *A General Introduction to Psychoanalysis* (Garden City, N.Y., 1943); trans. Joan Riviere, p.60.
14. This is as true of scientific theories as of metaphysical or theological ones; what is being called in question here is that tyranny of reason which makes theory superior to experience. For example, to theorize that behind the material world there is a spiritual reality is not essentially different from theorizing that behind the same material world there is a mathematical reality. Indeed, there are things which are mysterious; but the practical question is 'How can I experience these?' rather than 'What can I conjecture about them?'
15. *The Assayer;* trans. Stillman Drake in *Discoveries and Opinions of Galileo.*
16. Quoted in E.A. Burtt, *The Metaphysical Foundations of Modern Science* (Garden City, N.Y.: Doubleday, 1954) p.68.
17. E.C. Pollard in *Yale Alumnus Magazine,* March 1955, p.7.
18. See the essay on John Dewey in John Smith's *The Spirit of American Philosophy.*
19. If one succumbs to such an impoverished and partial view of nature, then one is forced to posit some notion of the supernatural to account for those manifestations, such as human will and purpose, which do not seem to be governed by completely unconscious mechanical laws. It is the high regard accorded to nature by thinkers like Spinoza and Goethe that got them into trouble with both the naturalistic scientists and the supernaturalistic clerics. (Not infrequently, both of these tendencies co-exist in the same person, as if a denigration of nature needs to be balanced by a deification of something extra-natural, establishing rigid boundaries between various levels of being.)
20. Immanuel Kant, *Critique of Pure Reason;* preface to the second edition. (Italics added.) A similar appreciation of the scientific method is evident in the writings of Francis Bacon, the patron saint of the Royal Society. He writes, for example, "Nature should not only be studied 'free and at large (when she is left to her own course...)', but should be studied even more when 'under constraint', when 'by art and the hand of man she is forced out of her natural state and squeezed and moulded' ". (Instauratio Magna.) (*The Works of Francis Bacon,* ed. J. Spedding, R.L. Ellis, and D. Herth, London, 1857-74, 14 volumes), Vol. V, p. 145.
21. This preparation and waiting for the revelation of the higher is not a passive affair, as it might seem. This is not the place to dwell on this theme; suffice it to say here that the activity involved in this state is of a sort quite different from ordinary doing mentioned earlier.
22. Parmenides, *Diels,* Fr. 185. Exactly similar doctrine is found in Plotinus (*Ennead* VI.9). On the basis of such a theory of knowledge, in order to know something higher, one will have to become higher. This I take to be the central purpose of any spiritual tradition. The result of the scientific mentality in the realm of the Spirit is to attempt to seize – as with drugs – higher consciousness. It is forgotten that if the Spirit refers to anything higher than our ordinary self, the question is not how we can appropriate the Spirit, but rather how can we prepare ourselves so that we may be appropriated by the Spirit.
23. *The Republic,* 443.