

A philosopher, on looking at two familiar ways of seeking knowledge and truth, finds them generating the same kind of knowledge and ending with the same truth

Some reflections on

SCIENCE and th

By Jerome Ashmore

SINCE the days of the Enlightenment, if not before, there has been a tendency among writers of all kinds to comment on the differences between science and the humanities. Recently the expression of that tendency acquired a new feature in the form of the suggestion that, instead of threatening the security of theological doctrine or of metaphysical concepts, science is threatening to divide what traditionally has been a cultural unity within the western world.

Professor Gerald Holton points out¹ that, as long as both science and the humanities were part of a common core of early education, the two were in equilibrium. Great scientists took pains to write of their discoveries in a way that was intelligible to the nonscientist, and the poet Shelley urged artists to "absorb the new knowledge of the sciences". Goethe engaged in scientific activity and was a great poet as well. In our cultural outlook and practice up to twenty-five years ago there was no gulf of ignorance between the sciences and the humanities and compatibility between them was a matter of course. But events within contemporary science have changed this relationship. Professor Holton (along with Sir Charles Percy Snow²) sees science of today as generating a new revolution, one that ceases to be a mere continuation of the eighteenth century industrial revolution. A distinctive mark of this new scientific revolution is that, with it or through it, creative differentiation is occurring, and the result may be the formation of a permanent cultural dichotomy. The question arises whether

present endeavor in science is occurring on such a vast scale and becoming so highly specialized that it leaves the humanities behind and breaks the educational bridge which previously permitted interchange with them. Professor George Whalley sees the two fields as "not even similar being no more alike than analysis and synthesis".³ Frederick Burkhardt notes that, in the nineteenth century, educational interests were divided on the basis of mind and matter, and sees this dualism as stronger than ever today, and as seeking "to relegate science to a separate and limited sphere of knowledge and action, to furnishing services and material goods".⁴ Another observer, Father Robert J. Henle, notes that a difference in epistemological orientation keeps the two fields apart.⁵

There are strong grounds for considering science and the humanities as conflicting pursuits. In a general way these grounds are found respectively in historical change, in individual differences, and in the common habit of judging all knowledge by its consequences in action. We have to accept the first factor, historical change, as we accept the tides and seasons. When the course of history reached the Renaissance, there was a change in attitude toward science. What among the ancient Greeks had been only one of man's expressions to be kept in balance with others in a "rational" life, and in medieval times had been an object of suspicion because of its neglect of spiritual affairs, became, during the Renaissance, an object affiliated with other conquests of the natural world. In a modified form, the view of the Renaissance continues to the present moment. Recently, historical events have jostled

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Humanities

men of science to a place in the foreground of human interests where their activities threaten to eclipse the liberal arts.

The second factor, that of individual differences, augments the shifting forces of history in affecting the common viewpoint about the relationship of science and the humanities. Given any group of human beings, the individual members differ in disposition, in direction of interest, in powers of sensory discrimination, in natural aptitudes, and in personal training. These differences contribute to a state of divergence of opinion about almost anything. Somehow man cannot eradicate an instinct for partisanship and all men will not respond alike to what is presented to them. Francis Bacon called this kind of partisanship an "idol of the cave". In this instance it acts to keep science and the humanities at odds with each other. The third factor, the popular modern association of knowledge and action, is one which leads to approval of science and neglect of the humanities, and so to a belief that the relationship of the two is one of alienation.

Communication about the relationship of science and the humanities is carried on more readily if it is described in terms that suggest a breach and appeal to a common appetite for hostility. Conflicts draw more attention than harmonies, and contrasting features often serve as an aid to exposition. Constant presentation of science and the humanities as in an antagonistic relationship invites the conclusion that there is something about their respective intrinsic characters which makes them opposed to each other. Clearly, when science is taken entirely as a means for biological survival, for eco-

nomic gain, and for a replanning of nature—in other words, when science is viewed as a handmaiden of technique—differences between science and the humanities are easy to find.

Here are a number of differences that have become familiar and usually are accepted as about all that need be said about the question of how science and the humanities are related:

Science is appropriate in the productive arts; the humanities are appropriate in the contemplative arts. Science tends to emphasize logic; the humanities tend to emphasize total human experience. Science approaches the world on the basis of means and ends, with a view to revision, and with its results expressed in abstract formulae; the humanities accept the world as it is seen as a whole, and reflect it as it is seen. Scientific expression is considered (at least by most nonscientists) to be without feeling; in its terms the world is hard, cold, colorless, silent, and inglorious. Humanistic expressions embody feeling and reveal a world that can be fragrant, colorful, and melodic and that can contain joy and love, can be harmonious with all of human experience, and can admit aspiration to some perfection.

Here are some more differences: Science is a game with a goal which is to reduce human helplessness; the humanities are not a game, and do not require a goal, because they always are at their goal; the humanities do not have to proceed toward something, since each of their expressions is a fulfillment. Science views an object under a system of regulated relations; the humanities do not impose systematic regulation on an object. Science is limited to symbols of discourse governed by a syntax and to serial expression of thought; the humanities are not so restricted in use of symbols: their symbols may be sensuous, nondiscursive, and simultaneously presented, and if verbal, syntax may be slighted. Science moves in a mechanistic domain of quantities, their measurements, and their causes; the humanities are concerned with a domain of qualities and their thematic composition. Science imposes measurement on experienced things and thwarts their expressiveness. The humanities allow experienced things or conditions to have their own expressiveness. Science states meanings; the humanities express them. Science has a signboard function; it sets forth the conditions under which an experience of an object or a situation may be obtained; it has directive efficacy. The humanities do not point to an experience; they are one. Science slights values; the humanities embrace values. Science presents an edited formulation of experience,

processed through its accumulation of conclusions; the humanities present experience concretely and freshly as in its natural state. Science favors highly specialized demonstrations following a predetermined structure of reasoning, developed discursively; the humanities omit highly specialized explanations. Science strives to avoid unknowns in the data it is treating and to present conclusions without them; the humanities include unknowns in their expressions and exhibit something to be seen in various ways rather than in one way specified by steps leading to a conclusion. These contrasting properties would seem to represent the conventional outlook toward the relationship of science and the humanities and to serve as evidence for classifying them as diverse pursuits.

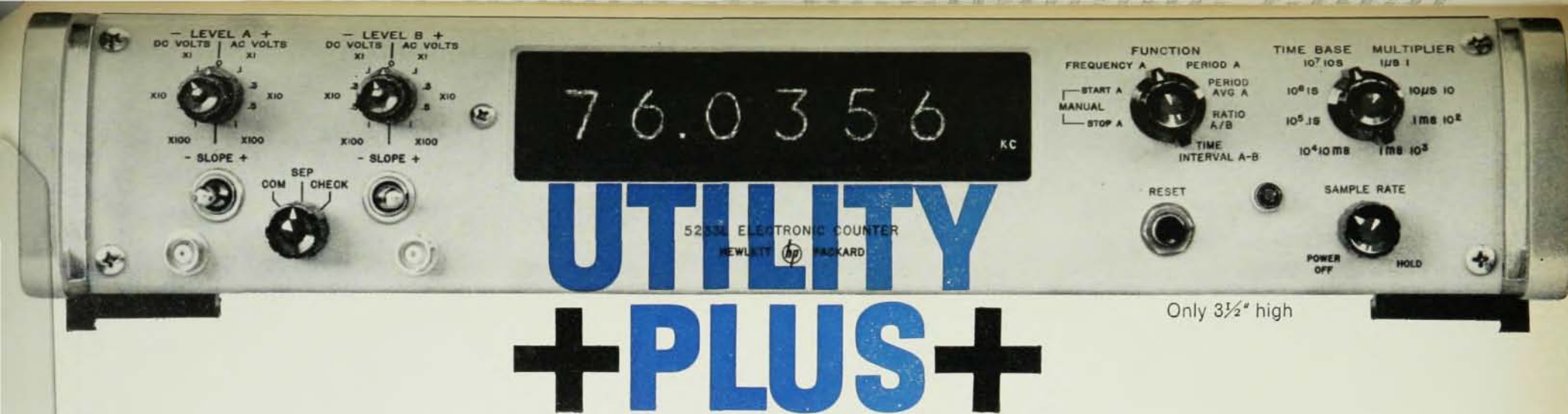
In all of the above comments, common reactions to the relationship of science and the humanities have been emphasized, and no alternate approach to it has been considered. Yet there is one. There is a perspective in which the two need not be seen as antithetical and almost exclusive; and may be seen as kindred and congruous. Suppose science and the humanities are viewed with nothing in mind except how they are related to knowledge and to truth. Suppose they are considered intrinsically instead of being attached to some external human aim. Suppose, too, that each may be seen as having an area of origin, a development, and an end within itself. With such assumptions, the two become thoroughly compatible and have some common characters. The point suggested is that of themselves, as knowledge-seeking enterprises and apart from pragmatic accompaniments, science and the humanities begin under the same conditions, develop into two different kinds of expressions of these conditions, and end with one and the same kind of knowledge.

Perhaps a word is needed about what the terms, science and the humanities, signify in the present context. In general, they signify a product of human functioning. This product is considered as provoked by the presence of objects or processes of nature which stimulate man to have faith in the existence of these objects or processes, and to attempt to have a relation with them which he calls knowledge of them. His attempts to record this knowledge are embodied in form, but two species of form are required and the knowledge indicated in each involves different assumptions. The species are called respectively science and the humanities. Science is a pattern of human activity emphasizing exercise of the intellect. In this pattern the attempt to formulate ideas about natural phenomena be-

comes a tissue of causal or statistical explanations and general laws that will hold within an assumption of a mechanistic universe. The humanities are human activities in which the attempt to formulate ideas about natural phenomena slights mechanically causal explanation and statistics, does not assign supremacy among psychological functions to the intellect, and admits variety in assumptions about the character of the universe.

But neither science nor the humanities can impose truth; the decisive agent in determining truth is the state of nature. Truth is the state of coincidence of the universals, preserved as what are called concepts, and some moment of natural existence called a fact, or a series of moments called an event. This coincidence is something toward which the human mind will move, but it is not something from which man may abstract a formula for legislating as to what particular fact or event shall be true. Any particular truth is contingent in the sense that it is exemplified solely by chance: it happened to be the one chosen by nature's flux. Neither science nor the humanities can regulate truth. But both can attain it when nature falls in with the concepts of either. Nature does not conform to science or to the humanities. They endeavor to conform to it. And, at times, both have been reasonably successful in their endeavors.

The common beginning of both science and the humanities is the human organism, particularly its various psychological functions. Each of the two begins with a psychological allotment having the same components: instinct, intuition, sensation, perception, imagination, feeling, and intellect. From this common origin, with this like equipment, each proceeds toward an expression distinct from that of the other by reason of the psychological features emphasized: science associates itself mainly with the intellect; the humanities associate themselves mainly with the processes of intuition, sensation, feeling, and imagination. But this is not to say that there is no residue of the fruits of intellect in the humanities, nor that in the expressions of science there is no residue of intuition, sensation, feeling, and imagination. The comparison being made concerns emphasis, not exclusiveness. Science cannot dispense with sensation any more than the humanities can dispense with intellect. Each expression is something done with the whole human organism. Again, the direction of the psychological functioning is the same: from a subject to an object, which is to say, from the same totality of psychological equipment to some object selected by instinct and attention. The object selected is not the same one



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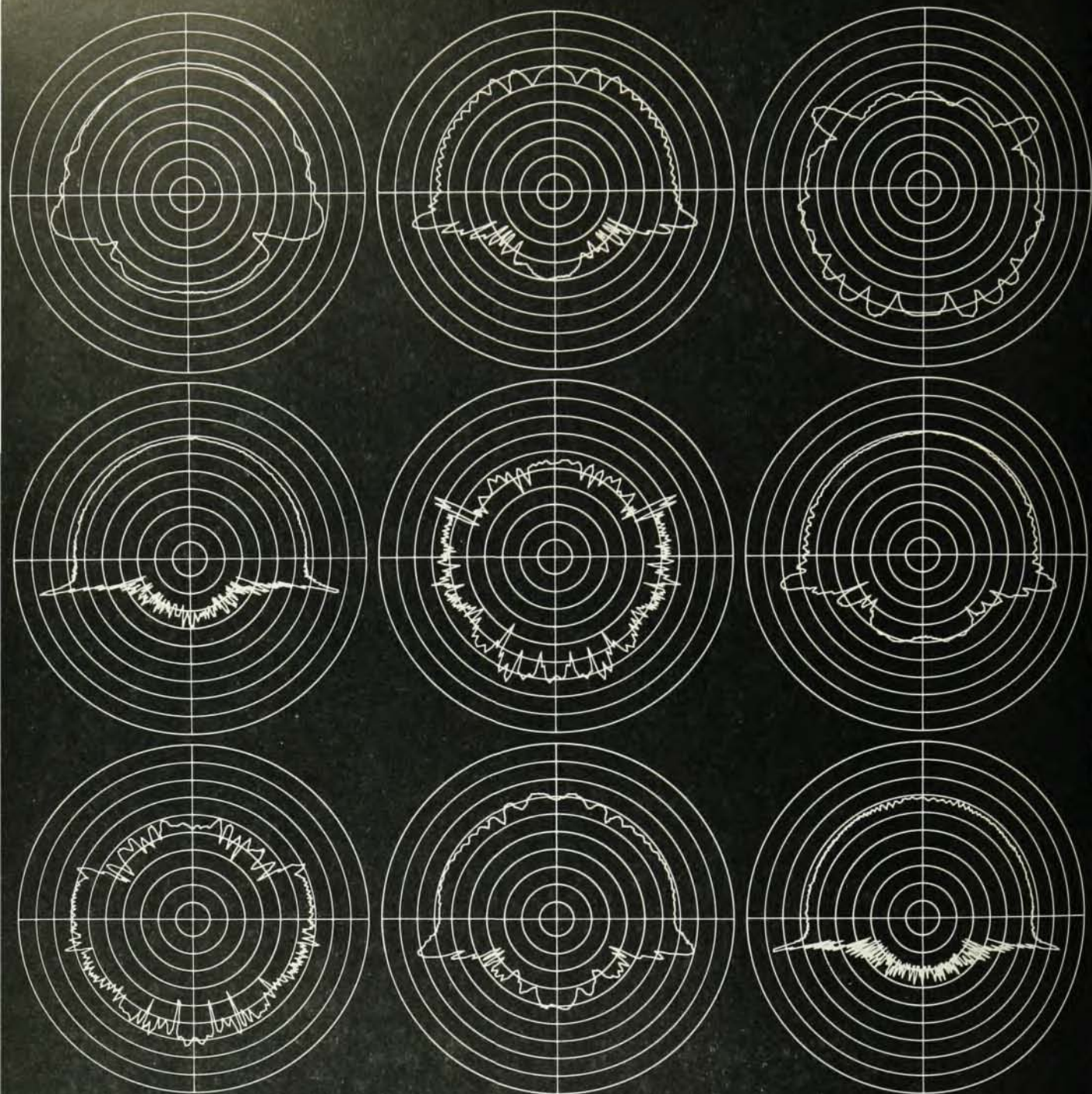
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in each instance, but it is an object. It may be visible in a physical state or it may be an imaginative datum; nevertheless it is an object toward which the organism turns its faculties.

A recurrent, but misleading, belief associates science with understanding and the humanities with imagination, as if understanding and imagination were separate and distinct functions, whereas understanding is in effect, as Santayana pointed out, a degree of imagination. Left to itself understanding would be helpless: it could not decipher the deluge of sensations which floods the mind. Understanding has to be inextricable from imagination. Without imagination perceptions would be isolated units. But they never are, because imagination always acts in alliance with perception to extend it beyond an atomic state. Only by abstraction could understanding be seen as solitary and pure, in its living functioning it never is. Of course, understanding is not highly imaginative. But, in order to function as understanding, it must allow itself to be represented by some degree of imagination.

Imagination not only is inextricable from understanding, it also is inextricable from intelligence. The products of the functioning of the amalgam of understanding and imagination, usually called understanding, and of the amalgam of intelligence and imagination, usually called intelligence, are fictions. It follows that both science and the humanities are fictions. But there are varieties of fictions: some assume a form corresponding to some moment of the flux of the outer world and some do not. Those which do not are considered exclusively imaginative. It appears that, although intelligence has no existence without imagination, imagination may run on without intelligence. Imagination without intelligence is called fancy, but usually imagination is blended with intelligence as one function constantly aiming to know things as they are. Understanding enters in the case where the fictions of imaginative intelligence take the form of a means through which man interacts with his environment. Essentially understanding is a fictional activity with consequences which have application in the surrounding world. From the standpoint of knowledge, the property of having application does not exclude the property of being a fiction. Two plus two equal four is a fiction which has immense application.

Science and a large part of the humanities are human discourse, and all human discourse is metaphorical, for perceptions and thoughts are signs for their objects and not copies of moments in the flux of nature which they seek to describe. Thought is

one stage removed from nature and words are one stage removed from thought. A thought about a natural object is fiction about that object and a word is fiction about the fiction which is thought. Understanding is fictional in the sense that it does not interpret an event in terms which are an identity with the event. Science, too, is fictional whether it is functioning within understanding or within higher reaches of imaginative intelligence. The fictions of science differ from other fictions in that they usually are incorporated in a methodology and produce a record of how nature and her creatures act. In the history of science there is a continual rejection of one fiction and substitution of another. There is no need to comment on the humanities as fiction; everyone accepts them as such.

It appears that both science and the humanities rely on the same ingredient, imagination, in one or another of its manifestations. Both arrange selected data according to some form in an act of imagination. Both forge into a unity data that were disparate: science through the vehicle of symbols governed by a syntax; the humanities through imaginative states achieving, in some ineffable way, a symbolic unity from a given variety of components. Both lead to form, but the form of science is regulated to the end that the statements made within it may be identified as true or false, whereas statements in the humanities include an ingredient of life and feeling and are not subject to some pre-arranged system of testing for properties of truth or falsity. The truth of science frequently is truth in a linguistic context; the truth of the humanities is truth in the context of lived experience.

Granting an assumption about the constitution of the universe made by Alfred North Whitehead, the object toward which the subject turns, whether he is a scientist or a representative of the humanities, has properties peculiarly fitted to each. Whitehead saw, as present in the external world, and as an inexpugnable and functional part of it, a component of feeling. For him, every event in the universe has a polar constitution. Every event has an objective pole and a subjective pole, the two comprising an indivisible unity. The assumption suggests a similar polarity between the intellect and the remaining psychological elements or functions within the human organism. All of the psychological elements constitute an indivisible unity, but the intellect tends toward producing the forms of science and the remaining elements tend toward producing the forms of the humanities. The complementary psychological components of the subject seeking to know engage in efforts which are complementary

with reference to an interpretation of the constitution of the universe confronting them. When the objective pole of events is the focus of attention, physical science asserts itself: matter, motion, and a space-time continuum become prominent, and symbols about motions of bodies in a four-dimensional system are organized into a form. When the subjective pole of events obtains attention, feeling and value become prominent, and symbols about qualities are organized into a form. Yet such a division of functioning is not sharp. The expressions of science have an ingredient of value and the expressions of the humanities are not without reference to space, time, matter, and motion. Some parts of the humanities come closer to the objective pole of events than others. The scope of philosophy, of history, of architecture, and of the creative sector of mathematics is closer to the scope of science than is that of poetry, music, painting, and sculpture. But, at least, if Whitehead's universe is accepted, science and the humanities are not in conflict with respect to what they are interpreting. They are cooperating, having the common objective of understanding this universe and the complementary functions of contributing truth about different parts of it. Science is reporting on the pole of objectivity in events and frequently the humanities are reporting on the pole of subjectivity.

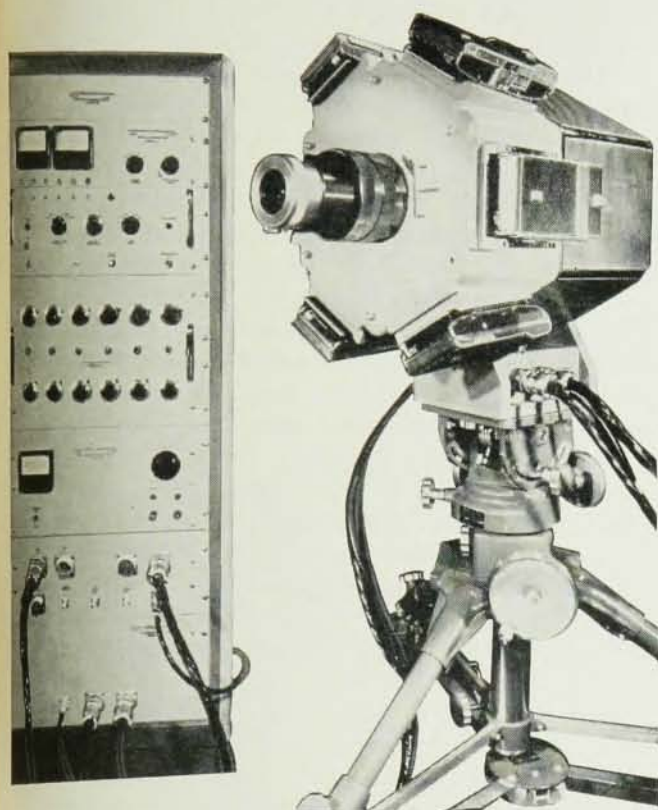
Truth, as mentioned, is what results when a universal fits a fact or event. Consider the universal, red, and the expression of truth: This apple is red. The coincidence between the universal, or concept, red, and the fact named apple is an example of truth as reached by the humanities. It involves sensation and possibly feeling. Now consider the universals or concepts: two and plus. The expression of truth, two apples plus two apples equal four apples, is an example of truth as reached by science. It involves intellectual dexterity and some prior sensation. When anyone is enlightened or deceived, it is not because of the intrinsic character of concepts, such as red, two, and plus. It is because of the coincidence of these concepts with the flux consisting of natural moments and events. Logical relations, such as two plus two equal four, are not true because they are clear and distinct, and sensations or sentiments are not false because they are vague. There is a temptation to forget that ideas point to truth, but that ideas themselves are not truth. Purely as an idea, two plus two equal four is neither true nor false. It is clear, distinct, correct, and articulate. But it is not true until it refers to a relation of some facts or events of nature. Before that reference, it is logical apparatus

but not truth. In the same light, sensations and feelings are not true or false in themselves, and they may lead to truth as genuine as that pointed out by mathematics. There are not two kinds of truth. The agency hitting upon the truth in no way affects the authenticity of the truth hit. The higher probability that science will strike truth does not give truth referred to by science an authenticity different from truth referred to by the humanities.

Besides being kindred in their deliverance of truth, science and the humanities purvey the same kind of knowledge. To appreciate this point a distinction must be made between two kinds of knowledge, one denoted literal and the other denoted symbolic. Literal knowledge is the kind which does not contain a term referring to an object external to the human mind; symbolic knowledge is the kind which does contain a term referring to an object external to the human mind. Knowledge is a transitive condition, it refers to some further object, not to itself. Our sense data and our concepts are not dead ends in themselves, but are indications of something ulterior. Both science and the humanities identify this further object with symbols, and their symbols are their knowledge. Accordingly, both offer symbolic, not literal, knowledge. Their knowledge is something which is not true literally, but is true only as language is—that is, symbolically. The symbols representing knowledge may be effective pragmatically, as in science, or may be insignificant pragmatically, as in the humanities; but in either case the knowledge involved is symbolic. The success of science in imposing controls on some particular aspects of nature's process is not equivalent to literal knowledge of these aspects. Professor Bridgman's operationalism was an attempt to give science terms which were not arbitrary symbols alone, but were literal operations. However, although operations are themselves natural events, they are not closer to identity with the other natural events to which they refer than is the symbol or noun they replace.

Science has literal acquaintance with the logical relations it employs. It literally knows arithmetical operations, various algebras, and various calculi because these are constructions without existence; they are ideal data that are naked within the mind of the scientist. He literally knows that two plus two equal four. He does not literally know that two apples plus two apples equal four apples. The real character of physical objects is recondite or unintelligible even though their movements may be symbolized and successful prophecy of these movements may be made. In the humanities, especially

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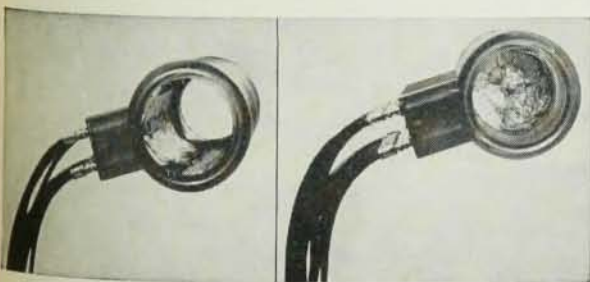
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in the discipline of philosophy, a main theme, perhaps the only theme that matters, is the relation between the flux of existence and the translations of it in the multifarious terms of reason and imagination. Philosophy is perpetually aware that literal knowledge of any object in the flux involves the superhuman feat of seeing it from its own point of view.

In any scientific enterprise, what is given *for* analysis is not the same as what is given *through* analysis. In the presentation of objects to mind and in mind's processing of these presentations, two different kinds of data are involved. To use the terminology of Professor Jakob Loewenberg, who is celebrated for insisting on this distinction, one kind of data is *preanalytical* and the other is *postanalytical*. The distinction illuminates the fact that what is given to the scientist before he employs his measurements is not the same as the data of his reports, which consist of his perceptions, his measurements, and his discourse. Astronomy is a tapestry of postanalytical data; the stars are pre-analytical data. Astronomy is not literally the stars. Astronomy is a congeries of symbols of something referring to the stars. It may tell truths about them. Its calculations and its prophecies are not necessarily false. Nevertheless astronomical calculations and hypotheses are not the stars. Nor are natural things found nearer to the human organism than stars the same as the psychology and the discourse which reports them, and the knowledge, which the reports claim, is symbolic, not literal knowledge.

What science assigns to a natural object may or may not resemble part of the object, but is not at all an equivalent of it. The predicates science assigns are in the domain of description and do not identify the object in question intrinsically. The reference to properties of the object or the prophecies about its behavior are determined by the structure and functioning of the organs of man, rather than by exhibition of the intrinsic character of the object. The perceptions of the investigator are true as a signal provided by the object and are true when interpolated with the investigator's stock of universals, but they are false as a description of the object in itself. The object in itself is not seen through them; they are a synthetic compound leaving undiscerned a definite remainder. In subnuclear physics, when studies of a particle reveal something more than is accounted for by prevailing equations, the "unknown" residue of the object is heeded and reconciled with scientific claims by saying that the particle has the property of strangeness. But so has every other object of science. The

scientist's use of symbols may be precise, but it does not produce literal knowledge of nature.

In summary, if science and the humanities are seen primitively, that is, solely as efforts toward knowledge and truth, they are in part similar and in part complementary. Both are consequences of impulses in man. He has five senses to gather acquaintance with a minute part of the infinity of vibrations occurring in nature; he has a moderate power of understanding to interpret what those senses may bring to him; and he colors his interpretation with an irregular and passionate fancy. These endowments of man's mind are not altered by the direction in which his impulse takes it. Moreover, whatever the constitution of the universe, science and the humanities end with the same kind of knowledge about it, that is, symbolic knowledge. They end, too, with one and the same truth, that is, coincidence of the concepts native to each with the ever-changing surge of the flux. The truth in science is useful externally; often the truth in the humanities is useful internally. Truth in science depends on the coincidence of some bit of nature's vast and incessant process with a statement of logically correct relations. Truth in the humanities depends on a coincidence of something from the same process with extra-logical statements that may invoke sensations, feelings, and a special exercise of the imagination. But there is only one truth and, within the limits of each, both science and the humanities attain it. They have a common origin and a common destination. Both are consequences of minds composed of the same psychological elements, reacting with the same external universe, generating the same kind of knowledge, and ending with the same truth.

Of course, if science and the humanities are placed in a perspective wherein they are seen only as instruments to satisfy some human craving for control of environment or for acquiring some other kind of power, the two are somewhat less than compatible. In this perspective, administrators of education, politicians, and journalists may find grounds for pointing to them as sources of a bifurcation of western culture. But if the character of science and of the humanities is viewed intrinsically and completely, they do not seem to be a sufficient condition for such a bifurcation.

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