

# WHAT IS THE PHILOSOPHY OF SCIENCE?

Although the problem of the philosophy of science has been under discussion for some twenty-five years, it is still very much a current problem, and one that scientists themselves regard as crucial. There is a wide range of views on the question, and the debate among them continues to be vigorous. For purposes of our discussion we may list four alternative solutions as typical of many of the opposing views on this subject.

Among scientists, first of all, there are two opposing views. One would deny that there really is any such thing as the philosophy of science. It would admit as valid only the individual sciences, denying the existence of any fundamental unity among the sciences and rejecting the possibility of any worthwhile knowledge apart from science. For this view, philosophy is at best a parlor game.

A second position on the philosophy of science, perhaps the one most popular among contemporary scientists who are also inclined to philoso-

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phize, admits that there is some unity within science. There is a unified outlook among the sciences, and given sciences are necessarily related to some extent in their method and doctrine. According to this position, the philosophy of science consists primarily in the discussion of this unity, particularly in terms of its logical coherence.

Among philosophers there are also two views, both in some sense opposed to the previous two. One of these, the third possibility for purposes of discussion, maintains that although science can be said to have some unity in itself, it is ultimately through metaphysics (metaphysical cosmology) that the foundations of science are secured and its unity guaranteed. Philosophy and science are distinct, but science without philosophy is ultimately incomplete.

Finally, there is the view that philosophy alone deserves the name of *science*; the modern so-called sciences are merely opinion, beneath the true "scientist."

We shall not consider here either the first of the views listed, which may be characterized as that of the practical scientist impatient with speculation, or the last, which may be said to represent the view of the idealist metaphysician. Either of these opinions would in effect cut the ground out from under any meaningful philosophy of science, and hence they cannot be said to contribute anything positive to the discussion of such a philosophy.

The second of the four views, which may be said to have grown most directly out of science and scientific self-criticism, can be characterized as logical empiricism or the logic-of-the-sciences school. For this school the function of philosophy is restricted mainly to explaining the various types of scientific statements, the manner of expressing scientific findings, and the logic employed by science in arriving at its conclusions. Philosophy, in short, is primarily, if not exclusively, a logic of the sciences. A fair representation of this outlook toward the philosophy of science can be seen in Ernest Nagel's recent work, *The Structure of Science.*\*

In the view of logical empiricism, science is defined as a logical system of explanations. We must be clear as to the meaning of "explanation" as used in this sense. First of all, a scientific explanation does not tell us why something occurs, but merely describes how or under what conditions it occurs. A second point is that deductive or syllogistic reasoning, so impor-

<sup>\*</sup> Ernest Nagel, The Structure of Science, New York: Columbia University Press, 1961.

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tant in traditional philosophy, is rejected by the logical empiricists as having no explanatory value in modern science. The reason for this is that deductive reasoning proceeds from premises which are known as universally true, and proceeds to particular conclusions which were not originally known. According to the view of logical empiricism, the development of science has shown that in practice it is impossible to know whether any premise is universally true; the most we can hope for is a premise that is compatible with known facts. Then, too, science will often accept an explanation even if it has not been concluded from what was better or more generally known. Scientific explanations, then, are not based on deductive reasoning, but tend rather to be based on probability or on mathematical relationships among measurable properties of things; sometimes, too, they are merely descriptions or narrations of facts that occur in more or less regular sequence.

These scientific "explanations" attain the status of laws chiefly according to their logical relation to one another in a system. The scientist does not regard laws as absolute or ultimate explanations of any particular reality, and, in fact, he often uses laws, such as mathematical formulas, which abstract entirely from the real, physical causes of things. In admitting a statement as a law his chief concern is that it have some logical connection with other explanations so that the systematic unity of the science may be preserved. In other words, laws are regarded merely as logical tools for investigation, and can be discarded whenever betters tools are discovered.

Further synthesis is obtained through the medium of theories or logical constructions, whose contents are sufficiently vague or undetermined to render them capable of being applied to a wide variety of experimental laws. Since theories are mostly logical fictions whose elements do not exist in reality, they are not said to be either true or false; their only criterion is their utility in synthesizing or relating experimental laws. In fact, contrary theories based on different premises are often used successfully in the same area. For example, a liquid cannot be something continuous and at the same time be composed of separate particles. Nevertheless, different theories based on these opposing premises have been applied with equal success.

For logical empiricism science can never claim to know the nature of physical reality, for the very requirements of the scientific method eliminate any such knowledge from its scope. The most that science can attain in regard to the physical world is a logical system of explanations—synthesized, where possible, into laws and theories—which are in harmony with

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regularly observed facts. And to this knowledge philosophy adds nothing other than a more precise analysis of the different types of scientific statements and the logic whereby science reaches its conclusions.

The third view listed above is essentially a restatement of the Louvain position as found, for example, in the writings of Fernand Renoirte and Andrew Van Melsen. The Louvain school adopts the logical empiricist view with regard to the character of scientific knowledge and the incapacity of science to attain to the nature of physical reality, but rejects the logical empiricist restriction of philosophy to an analysis of the logic of the sciences. For the Louvain school, there is a distinctly philosophical knowledge of nature which is independent of the positive sciences. This philosophy of nature, or cosmology, has as its object the very nature of material reality itself; and in attaining its object, it supplies for the fundamental incompleteness of the positive sciences and provides the basis for their unity. When taken in conjunction with the Louvain teaching that all speculative philosophy is identical with metaphysics, this means that in metaphysics alone are to be found the ultimate explanation of physical nature and the basis for the unity of the sciences.

In arguing for the necessity of an autonomous philosophy of nature on a level apart from the sciences, the Louvain school points out that all the sciences are based on the presupposition that material things are organized in a species-individual structure, that is, that there are various classes and kinds of things in the physical world. This presupposition is not merely peculiar to some particular scientific theory; rather, it is of a pre-scientific character altogether. It is knowledge which is derived from common experience, and must be at the disposal of the mind before any scientific inquiry can begin. No science, of course, can discuss or prove what is already presupposed to it; yet, the presupposition of a species-individual structure must be analyzed if truly adequate knowledge of the physical world is to be attained. This necessary discussion or analysis takes place in cosmology or the philosophy of nature.

Both science and the philosophy of nature, therefore, begin with common experience, but each investigates a different aspect of common experience. Science and philosophy are mutually independent, in that neither can contribute directly to the other. The results of scientific investigation cannot contribute anything new to the philosophy of nature, because these results are obtained by methods which presuppose the starting points of philosophy; consequently, the results of science do not shed any new light on these starting points. Nor can the philosophy of nature be of direct value for science, because it is concerned with those features of matter already considered independently by science.

The difference between philosophy and science is sometimes explained by adherents of the Louvain position according to the three degrees of abstraction enumerated by St. Thomas. In the first degree, the objects of knowledge depend on sensible matter both to exist and to be understood, and all conclusions are verified on the level of the senses; to this degree pertain all the experimental physical sciences. In the second degree, the objects depend on sensible matter to exist but not to be understood; to this degree pertain the mathematical sciences. In the third degree, the objects do not depend on matter either to exist or to be understood; some of the objects in this degree of abstraction never exist in matter, while others, such as substance, act, and potency, can exist either in matter or apart from it. Conclusions on this level of abstraction are verified not in sensible experimentation but only in the intellect. This is the level of metaphysics, of which cosmology or the philosophy of nature is a branch. Cosmology is concerned, of course, only with material phenomena, but analyzes them metaphysically under the aspect of being. It does not depend on experimental evidence, but seeks verification for its conclusions in the intellect alone.

Thus for the Louvain school philosophy and science are distinct kinds of knowledge on distinct levels. This is not to say that these two knowledges are not related in any way whatever. As pointed out earlier, the experimental sciences are of themselves fundamentally incomplete and need philosophy as their ultimate unifying principle. Conversely, if the philosopher is to evaluate and unify the sciences, he must evidently have a knowledge of them to begin with. The point remains, however, that the basic unity of the sciences is supplied on a level apart from the sciences themselves. It is supplied from above by philosophy or, in other words, by metaphysics.

The stand of logical empiricism and that of the Louvain school both have a great deal of truth in them, yet the opposition between the two views is such that both cannot be entirely true. While both schools agree on the nature of the sciences and on the impossibility of true certitude in scientific knowledge—and we may allow their position on these points to stand for purposes of our present discussion—they differ sharply on the nature and function of philosophy in relation to science. The logical empiricists hold that the philosophy of science is no more than a logic of the sciences on the same level as the sciences themselves; it is not another and

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more certain knowledge of nature apart from science. For the Louvain school, on the other hand, the philosophy of science is on a level entirely above the sciences; and it is on this level, the level of metaphysics, that a certain knowledge of the ultimates in nature is achieved and the unity of **the sciences secured**.

The ultimate truth of the matter would seem to lie somewhere in the middle ground between these two positions. Somewhat more merit can be found, perhaps, in the empiricist side. After all, the question of a philosophy of science first came up among practicing scientists dissatisfied with certain aspects of their work, and today's logical empiricists are their direct descendants and heirs. As scientists, they are the more capable of judging whether or not there is in fact a unity intrinsic to science. They are acquainted with the methods of science at first hand and judge science with a genuine sympathy that can be lacking even in the most conscientious non-scientist.

To be sure, there is in this school a bias with which one cannot agree, a bias against theoretical reasoning on a general level. Such a bias is indefensible for two reasons. First, from a speculative point of view, there really is no sufficient reason for rejecting deductive reasoning. The denial of the validity of such reasoning seems really to constitute a gratuitous assumption on the part of the empiricist. Second, in the practical order, there is in fact much deduction employed in modern science, particularly in astronomy and atomic physics, to cite two obvious examples. Nevertheless, aside from its unjustified dismissal of theoretical or deductive reasoning, the position of logical empiricism seems the more reasonable in maintaining that the unity of science—and the philosophy of science—are to be sought on a level with the sciences themselves.

On the other hand, there is much truth in the attitude of the Louvain school as well. We certainly cannot rule out the role of metaphysics, especially when the question is stated in terms of fundamentals or ultimates. Metaphysics does have the quite legitimate task of setting science, as well as all other things, in proper perspective in the total scheme of being. In addition, metaphysics can view a particular problem from a higher, more universal level, and thereby detect shortcomings in argumentation that should lead to re-examination of the problem on the particular, lower level. This is, in fact, often done by the logical empiricists themselves. Frequently they are being unconsciously metaphysical when they think they are merely giving a logical critique. Nevertheless, even on the level of fundamentals or ultimates, the Louvain position does not seem entirely correct. In particular, the view that cosmology is a part of metaphysics does not seem well grounded, at least not in any teaching of St. Thomas.

The implications of the foregoing remarks seem to point to the possibility of a general philosophy of nature on the level of the sciences themselves—a sort of *meta-science*, so to speak. Such a conclusion, in fact, seems inevitable if one is to find a middle ground between the two opposing positions herein described. On the one hand, it respects the intrinsic unity of the sciences which is stressed by the logical empiricists; while on the other, in accordance with the Louvain view, it takes account of the value and necessity of deductive reasoning, and in addition leaves room for a more fundamental unity among the sciences to be obtained in metaphysics.

—Aquinas Williams, O.P.—Antoninus Dempsey, O.P.—Luke Prest, O.P.

The foregoing is the outcome of a symposium carried on at St. Stephen's College, Dover, Massachusetts. Since the symposium is here presented in the form of a unified article, some of its original spontaneity has naturally been lost. Nevertheless, it is presented here as an indication of how a dialectical consideration of alternatives—in this case, concerning the philosophy of science, can suggest the moderate intermediate position which is most in accord with the realism of St. Thomas.