

Introductory Reading  the

Philosophy of Science

Revised Edition

Edited by

E. D. Klemke

Robert Hollinger

A. David Kline 

Introductory Readings in the

Philosophy of Science

Revised Edition

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Preface

To the Revised Edition

This revised edition, like its predecessor, is a collection of informative, lively, and accessible readings, organized under six main issues, and designed to provide a solid introduction to the problems of the philosophy of science.

We have been gratified by the response of both instructors and students to the first edition of this text. For this new edition we have made a number of what we hope are improvements.

Probably the most often expressed concern with regard to the first edition was the need for a better selection expressing the views of Thomas Kuhn. We not only remedied this but included a paper by Carl Hempel that examines some of the important themes raised by Kuhn.

The first edition did not contain a version of the standard account of theories given that most presentations were far too technical. The now-included essay by Rudolf Carnap is a nice nontechnical representation of the view. For similar reasons we only included a very qualitative discussion of confirmation in the first edition. The selection on the logic of confirmation, now included, was especially written for introductory students by Ronald Giere. It may require some additional help from the instructor but we believe it will be well worth the effort.

The opening part, "Science and Nonscience," has been expanded by one essay. This topic is especially exciting to introductory students. Our earlier suggestion, that one may want to wait until other topics have been covered to take up this issue, still stands.

The final two parts, on science and values and science and culture, which also have proven to be quite interesting to a variety of undergraduates, have been significantly revised. We eliminated essays that were too difficult or

repetitive. The new essays also relate more directly to issues in the previous sections.

We would like to express our deep gratitude to all those people who helped us, in various ways, to prepare this book. In addition to the many who aided us with the first edition (see the preface to that edition, reprinted in this volume), for this new edition we are grateful to Carl Matheson, Warren Asher, Bernice Power, Edna Wiser, Ray Amsler, and Steven L. Mitchell and the entire staff of Prometheus Books.

Finally, we hope that instructors and students who have comments or suggestions for improving the volume or who wish to convey their evaluation of it will contact the editors.

E. D. Klemke
Robert Hollinger
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Preface

To the First Edition

It is a truism that in our time science has become a highly respected and venerated enterprise. It is widely deemed to be a Good Thing. There are many who hold it to be the most successful pursuit of knowledge in the history of the world. Others consider it to be the noblest intellectual achievement of mankind. It is also true that (in recent years, especially) many have found science to be undeserving of such high praise. Not only has science been attacked by proponents of ESP, astrology, and other pseudosciences, and by critics of modern technology; it has even been found wanting by some scientists and ex-scientists and others who know and write about science. (See Paul Feyerabend's essay in Part 1 of this volume.) Who is right, or more nearly correct, in this controversy?

It is our hope that the reader of this volume will be able to arrive at his or her own answer to this question. However, in our view, one cannot attempt to answer such a question without a clear understanding of what science is and what it is not. One of our major goals has been to provide that understanding and to provide it in such a manner that it is accessible to the beginning student and the layman.

Hence we would like to stress that this is an *introductory* work in the philosophy of science. Our principles of selection for the readings included have been these: The selection should be intrinsically interesting. It should be comprehensible to a beginning student. It should serve to provoke discussion and criticism. We have also tried to stimulate a kind of dialogue among the authors by selecting works which present varying and even conflicting points of view.

We have presented the topics in the order we have found to be most desirable. However, there may be one exception. Part 1 could be used either first or last—or, perhaps best of all, both. Otherwise we believe that the order

of presentation should be followed. (However, it is not necessary that every reading within each part be used.)

A few other comments are in order. First, although all three of us worked closely together on all of the material included, the general introduction and the introductions to the six parts were written individually, not collectively. (The initials at the end of each indicate primary authorship.) Second, the Study Questions at the end of each of the six parts were composed by the author of the introduction to that part. Third, the bibliographies—one is given at the end of each part (and at the end of the general introduction)—are not exhaustive. They are intended to provide further sources which deal with some of the major issues discussed in the volume. Fourth, although we have spent much time in revising our format and the selection of readings, we may have overlooked some items which ought to have been included. If so, we shall be grateful to hear from instructors who use the volume and to receive their suggestions with regard to this—or any other—issue.

We would like to express our gratitude to all those who helped in various ways with regard to the preparation of our initial proposal and the final manuscript. We are especially grateful to: Rowena Wright, Bernice Power, Annette Van Cleave, Richard Kniseley, David Hauser, and Steven Isaacson. We would also like to express our appreciation to the members of the Philosophy Department of Iowa State University for their constant help and encouragement.

Acknowledgments

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Introduction

What Is Philosophy of Science?

Most readers of this volume probably have some familiarity with science—or with one or more of the sciences. But the following question may come to mind: Just what is philosophy of science? How does it differ from science? How is it related to other areas of philosophy? We shall here attempt to provide answers to these and related questions.¹

I. What Philosophy of Science Is Not

Let us begin with a discussion of what philosophy of science is *not*.

(1) Philosophy of science is not the history of science. The history of science is a valuable pursuit for both scientists and nonscientists. But it must not be confused with the philosophy of science. This is not to deny that the two disciplines may often be interrelated. Indeed, some have held that certain problems within the philosophy of science cannot be adequately dealt with apart from the context of the history of science. Nevertheless, it is generally held that we must distinguish between the two.

(2) Philosophy of science is not cosmology or “philosophy of nature.” The latter attempts to provide cosmological or ethical speculations about the origin, nature, and purpose of the universe, or generalizations about the universe as a whole. As examples we may cite the views of Hegel and Marx, that the universe is dialectical in character; or the view of Whitehead, that it is organismic. Such cosmologies are often imaginative, metaphorical, and anthropomorphic constructions. They frequently involve interpreted extrapolations from science. Again, certain problems within the philosophy of science may aid the construction of or involve a consideration of such

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cosmological theories. But here, too, there is wide agreement that they must be distinguished.

(3) Philosophy of science is not the psychology or sociology of science. The latter disciplines constitute a study of science as an activity, as one social phenomenon among many. Some of the topics that fall within such an inquiry are: scientists' motives for doing what they do; the behavior and activity of scientists; how (in fact) they make discoveries; what the impact of such discoveries is on society; and the sorts of governmental structures under which science has flourished. Again, certain problems in the philosophy of science may on occasion be related to such issues. But once more, it is reasonable to hold that these inquiries must be distinguished.

For the purposes of our study, the philosophy of science will not primarily mean or apply to any of the above. We will not try to comprehend the history of science. We will not present any grand cosmological speculations. We will not try to understand the scientific enterprise in terms of human or social needs. However, with regard to the latter, it is desirable to make a distinction. It is one thing to present a psychological or sociological account of science. This we will not do. It is another thing to examine philosophically the relationship of science and culture and generally of science and values. The latter parts of this volume will be devoted to these issues.

II. What Philosophy of Science Is

Let us attempt now to see what the philosophy of science *is*. By one widely held conception, philosophy of science is the attempt to understand the meaning, method, and logical structure of science by means of a logical and methodological analysis of the aims, methods, criteria, concepts, laws, and theories of science. Let us accept this as a preliminary characterization.

In order to illustrate or apply this characterization, let us focus on the matter of the concepts of science.

(1) There are numerous concepts that are used in many sciences but not investigated by any particular science. For example, scientists often use such concepts as: causality, law, theory, and explanation. Several questions arise: What is meant by saying that one event is the cause of another? That is, what is the correct analysis of the concept of cause? What is a law of nature? How is it related to other laws? What is the nature of a scientific theory? How are laws related to theories? What are description and explanation in science? How is explanation related to prediction? To answer such questions is to engage in logical and methodological analysis. Such an analysis is what philosophy of science, in part, is (according to this conception).

(2) There are many concepts used in the sciences that differ from the ones mentioned above. Scientists often speak of ordinary things—such as beakers, scales, pointers, tables. Let us call these observables. But they also often speak of unobservables: electrons, ions, genes, psi-functions, and so on. Several

questions then arise: How are these entities (if they are entities) related to things in the everyday world? What does a word such as 'positron' mean in terms of things we can see, hear, and touch? What is the logical justification for introducing these words which (purport to) refer to unobservable entities? To answer such questions by means of logical and methodological analysis constitutes another part or aspect of what philosophy of science is (according to the conception we are considering).

Now, with regard to the kinds of concepts mentioned in (2), one might ask: Why analyze these concepts? Don't scientists know how to use them? Yes, they certainly know how to use terms such as 'electron,' 'friction coefficient,' and so on. And often they pretty much agree about whether statements employing such expressions are true or false. But a philosopher, on the other hand, might be puzzled by such terms. Why? Well no one has ever directly seen a certain sub-atomic particle, or a frictionless body, or an ideal gas. Now we generally agree that we see physical objects and some of their properties — spatial relations, and so on. The philosopher of science asks (among other things) whether it is possible that a term such as 'positron' can be "defined" so that all the terms occurring in the definition (except logical terms, such as 'not,' 'and,' 'all') refer to physical objects and their properties. He attempts to reduce or trace such "theoretical constructs" to a lower level in the realm of the observable. Why? Because unless this is done, the doors all open to arbitrarily postulating entities such as gremlins, vital forces, and whatnot.

As we can see, throughout such conceptual investigations as those mentioned above, the standpoint adopted by the philosopher of science is often a commonsense standpoint. Thus certain questions which may be asked by other divisions of philosophy (such as epistemology) are not asked here. For example, whether a table really exists. If one wants to say that this means that philosophy of science has certain limitations, then we must agree. But not much follows from admitting this, for those other questions can always be raised later when we turn to other kinds of philosophical problems. Hence for the philosophy of science, we do not need to raise them. We may use the standpoint of common sense.

III. Some Main Topics in Philosophy of Science

The characterization of philosophy of science we have given in the preceding section does not adequately cover all of the kinds of issues and problems generally recognized as falling within the scope of philosophy of science. Hence it is perhaps best to resist trying to find a single formula or "definition" of philosophy of science and to turn to a different task.

Let us now briefly consider some of the main specific topics and questions with which philosophy of science is concerned. (In this volume, we will be able to focus on only some of these issues.)