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is as self-contradictory as the old neo-Platonist Damascius found it 1,400 years ago. But what difference does it make to a philosopher who has transcended it? Is the religion of the Unknowable a serious danger to the moral life of modern man? Is the slight survival of this mysticism in the philosophies of a Wundt, a Spencer, or a Riehl a hindrance to concrete scientific progress? Many of the most vigorous leaders of modern thought answer these questions in the affirmative, and they may be right, *que sais-je?*

In thus endeavoring to expound the author's central thought, I have been forced to pass by the many interesting psychological *aperçus* which his book contains.

Especially noteworthy is the suggestion that the images or mental representations which the traditional psychology places between sensations and concepts arise frequently, if not normally, from a fusion of several elementary concepts and are not to be thought of always as direct copies of sensation. It was doubtless a feeling of this that led Plato in the *Philebus* to describe the imagination under the figure of an artist who paints the ideas which first arise in our minds as discourses of reason (*λόγος*).

PAUL SHOREY.

THE SCIENCE OF MECHANICS. By *Dr. Ernst Mach*, Professor of Physics in the University of Prague. Translated from the Second German Edition by *Thomas J. McCormack*. Chicago: The Open Court Publishing Company, 1893. Pages, 534. Price, \$2.50.

"The present volume is not a treatise upon the application of the principles of mechanics. Its aim is to clear up ideas, expose the real significance of the matter, and get rid of metaphysical obscurities. The little mathematics it contains is merely secondary to this purpose."

These are the opening words of the Preface of this work, which is essentially a treatise on the *evolution* of mechanics, and not a text-book of its principles, all the problems that have arisen in the science's development being dealt with historically and from the point of view of the theory of knowledge. In this sense it is as much a contribution to philosophy as to science, and will thus be of much more value to the student and inquirer than a simple statement of technical principles could be. In Professor Mach's analysis the reader sees how the principles of mechanics have in fact been *ascertained*, from what sources they take their origin, and what their *positive* and *physical* essence is, as distinguished from the technical guise they have historically assumed and which students now so often regard as their real substance.

The gist and kernel of mechanical ideas has, in almost every case, grown up in the investigation of very simple and special cases of mechanical processes. It is these cases with which Professor Mach deals. Here we see the science in its genesis, and feel the steps by which it has been created. We accompany the great investigators in their deepest quests, meet the same obstacles, and experience the same doubts as they; learning that they, too, were mortal men, who had to hew their

way through the same difficulties as we, in the solution of our problems. In this way, we follow the trains of thought of Archimedes, Stevinus, Galileo, Huygens, Newton, and Lagrange, and participate in the making of their great discoveries. Thus, we ~~live over in~~ our souls their intellectual lives.

The confidence and strength which we gain for our own labors in such work cannot be overestimated. No one can come away from the perusal of this book without being intellectually and spiritually bettered, or without having won a taste for employment with high thought and classical knowledge which will always profit him.

The parts of the work of greatest import to those interested in physics are, the sections on the development of statics and dynamics, the discussions of the foundations of dynamics, the criticism of Newton's views, the substitution of newly formulated and more logical principles for the Newtonian axioms and definitions, and the chapter on the "Formal Development of Mechanics." To the philosopher all is of equal interest, as he may here see the way in which a complete and perfected science has actually been developed, and thus have the opportunity, in constructing his theory of knowledge of adhering to facts.

The general reader's interest will probably be fastened with the two sections in Chapter V: "Theological, Animistic, and Mystical Points of View in Mechanics," and "The Economy of Science." In the first we read of the religious opinions of the great inquirers, of their struggles with their inborn theological ideas, (or rather of the struggles of these ideas with new and irreconcilable opponent-ideas,) and of the way in which science has always been tinged with religious, spiritualistic, and mythological conceptions.

In the section on "The Economy of Science" is contained, in succinctest form, the groundwork of Professor Mach's philosophy. In his view, all science is economy of thought. Economy of thought—the saving of mental time and labor—is the object of language, arithmetic, algebra, of all concepts, and of science generally. All this is illustrated by a brief discussion of arithmetical and algebraical rules, the theory of determinants, calculating machines, the laws of physics, and space of many dimensions. By the light of this theory the reader will understand many problems of abstract physics which were before obscure to him.

No pains have been spared in the mechanical execution of the work, or in insuring correctness of translation. The proofs of the translation were read by Professor Mach himself, and also by Mr. C. S. Peirce, who edited the division "Mechanics" in the *Century Dictionary*. Mr. Peirce has also independently supplied a few paragraphs on the measures and weights of this country and Great Britain. The book is exhaustively indexed, and at the sides of the pages marginal analyses of the paragraphs are printed. Of the two hundred and fifty cuts and illustrations which the work contains, all have been redrawn with the exception of the fac-similes of old originals, of which there are a number.

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