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THE SPECIFIC RATIONALISM OF ISAAC NEWTON

European philosophy of the 17th-18th centuries is characterized, among other things, by the efforts to find a solution to the scientific method problem. European philosophers and scientists attempted to solve this problem based on one of two strategies: 1) Empiricism (the philosophical idea that the only reliable source of scientific knowledge is experience). 2) Rationalism (the philosophical idea that the only reliable source of scientific knowledge is reason). Empiricism relies on observation and experiment as its scientific research methods (as evidenced by the research program of F. Bacon). The mathematics here is of secondary importance. Rationalism takes mathematics as a model of true knowledge, and it was in the 17th century that mathematics began to be used in the study of natural phenomena by people such as I. Kepler and G. Galileo. The field of mathematics, which began with obvious and indisputable truths, was recognized by the rationalists as the discipline most consistent with their own attitudes and, therefore, with the general method of knowledge. In this context, observation and experimentation played a pivotal role.

There are two epistemological strategies to consider: empiricism and rationalism. I posed the question, «Which of these two strategies did Isaac Newton follow?» Newton's work is often considered to align with the rationalist tradition, as he followed the philosophical tenets of G. Galileo and R. Descartes, who is widely regarded as the father of modern rationalism. What did this following of Newton manifest itself in? Galilean physics introduced a new conceptual framework, replacing traditional notions of physical phenomena such as velocity or heat with mathematical quantities. Cartesian physics replaced the objects of our everyday world with the extended bodies of the Cartesian universe. Newtonian physics represents an endeavor to further idealize both Galilean and Cartesian physics. In Newtonian physics, the actions we encounter in our everyday world (e.g., pulling, pushing, dragging, etc.) are replaced by the action of forces. Newton's replacement of ordinary action by the action of forces is an extension of Cartesian reduction. At the ontological level, Descartes abandoned the everyday world and created his mathematical universe of extended bodies. However, his understanding of action (as pushing and pulling) remained close to the ordinary notion of action. Pushing and pulling are fundamental to everyday life. When we write, we push the pen against the paper, and when we want to untie our shoelaces, we simply pull them. Descartes transferred our ordinary notion of action to his mathematical universe of extended bodies. Newtonian physics is generally understood as a consequence of replacing the Cartesian notion of action, based on everyday experience, with a new, mathematical notion of action that is completely alien to any experience: the action of forces at a distance. In other words: Newtonian physics is the physics of idealization (mathematization) of action. Newton completed the process of mathematization of nature started by Galileo by providing the mathematical description of action.

The idealization on which modern physics is based thus has three layers. The first layer is the Galilean instrumental idealization of phenomena. It consists of replacing the everyday world's phenomena with mathematical quantities obtained through measurement techniques. The second layer is the Cartesian ontological idealization of objects. It consists of replacing the objects of the everyday world with extended bodies received in the ontological reduction of reality. The third layer is the Newtonian analytic idealization of action. It consists in replacing action between the objects of the everyday world by forces acting at a distance. By distinguishing these three idealization levels, we are asserting that physical quantities are not true representations of the phenomena of the everyday world. Physical quantities are unambiguous, intersubjective, and reproducible, whereas phenomena of the everyday world contain a subjective dimension; they are often ambiguous and unreproducible. Similarly, we argue that physical bodies are not identical to objects in the everyday world. Physical bodies have unambiguous quantitative characteristics that can be combined into a «finite representable» state that contains all information about their future. Objects in the everyday world have qualitative properties, and their purpose rather than their state characterizes them. Finally, we argue that physical interactions are not identical to the causal relationships we encounter in the everyday world. Physical systems are mono-temporal and causally closed. Objects in the everyday world change simultaneously on multiple time scales and are open in a fundamental sense.

All this was possible because Newton went further in his understanding of mathematics. Newton took into account Galileo's view (mathematics is a language suitable for describing natural phenomena) and Newton's view (mathematics is the ontological basis of reality). Still, he went further: mathematics is a form of analytical representation of reality, a form of representation of time, space, and interaction. Newton created an idealized world with which modern science replaces the world of our everyday experience. This replacement is so successful because the world of science has its ontology and causality in addition to its empirical basis. Thus, the world of science is closed at the empirical level of facts, the ontological level of objects, and the causal level of action. Modern science can predict not only the results of experiments but also the existence of new objects.

In other words, Newton built an idealized (mathematical) model of everyday life. This model enabled Newton to rationalize our everyday experience. The aim is to transform sensory experiences into rational ones.