Reading the Use of Analogies in Newton's Philosophiae Naturalis Principia Mathematica

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Abstract. In Philosophiae Naturalis Principia Mathematica and in other mathematical works, Isaac Newton (1643-1727) resorts to magnitudes which, in modern language, should be called infinitesimal quantities. It is well known that Newton did not recognize the existence of actually infinitesimal quantities and numbers. His conception considers the infinity and infinitesimal as potential quantities. Nonetheless, on several occasions -(i.e., Principia, Book I: Proposition XXXIX, sect. VII and Proposition XLI, sect. VIII), where he deals with the so called inverse problem of the central forces, Newton argues of given infinitesimal quantities. The fact that these quantities are given, might induce to think of actually infinitesimal magnitudes. This is not the case. However, they cannot be considered ordinary potentially infinitesimal quantities. Rather, in our talk, it will be shown they represent a fiction, an analogy, which gets a particularly significant role as to the development of Newton's physical and logical argumentative structure. The use of analogy in science is a wide argument. The one made by Newton is exactly an exemplification of a correct use of analogy: the magnitude to which Newton resorts resembles, is analogous to an actually infinite quantity, but, in fact, it is not. Many other uses of analogy in science are not correct. In the second part of our talk, we will point out the differences between a correct and an incorrect use of analogy within science. We will refer to our researches developed on the subject on history of science, history of science & science education and epistemology of science.

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