

On the Conceptual and Civilization Frames in René Descartes' Physical Works

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Received April 15th, 2013; revised May 20th, 2013; accepted May 30th, 2013

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The paper try to provide a contribution to the scientific—historiographic debate concerning the relations between experiments, metaphysics and mathematics in Descartes' physics. The three works on which the analysis is focused are the *Principia philosophiae* and the two physical essays: *La Dioptrique* and *Les Météores*. The authors will highlight the profound methodological and epistemological differences characterizing, from one side, the *Principia* and, from the other side, the physical essays. Three significant examples will be dealt with: 1) the collision rules in the *Principia philosophiae*; 2) the refraction law in *La Dioptrique*; 3) the rainbow in *Les Météores*. In the final remarks these differences will be interpreted as depending upon the different role Descartes ascribed to the three books inside his whole work. The concepts of *intensity* and *gradation* of the physical quantities used by Descartes will provide an important interpretative means. In this paper, we compare the aprioristic approach to physics typical for Descartes' *Principia* with the experimental and mathematical one characterizing Descartes' *Essays*.

Keywords: Descartes; Newton; Collision Rules; Refraction Law; Rainbow; Intensity and Gradation of the Physical Quantities; Science and Society in the XVII Century

An Outline

On Science & Society. The social and civilization environment in which a scientist lives has profound influences on the way how his scientific results and methods are framed (e.g. see Schühl). This is specifically true for the 17th century, the epoch of the scientific revolution and a century of deep social and political transformations. Nevertheless, we think influence of the social-political work of a scientist has to be deduced directly from the analysis of his scientific works. In other terms: an analysis of the society in a certain period can be useful to understand the general direction taken by the science in that period, but, in itself, it is not enough to understand the specific work and results of a certain scientist. This kind of general analysis risks to become a sort of an *a priori passe-partout* through which the scientific work is analysed and risks to induce serious misunderstandings on the way in which a certain scientist presented the results of his researches. It is always necessary to begin a historical research—also a research concerning the relations between science and society in a determined period—from the alive, both theoretical and technical work of the scientists. If, in the analysis of the whole work of a scientist, the historian of science reveals some unclearness or internal inconsistencies or a lack of coherence between the methods used by this scientist in different works of his and if all these questions cannot be explained either with technical problems (for example the lack or the misunderstanding of

¹On that see a good essay by Buchwald and Feingold (Buchwald & Feingold, 2011).

certain mathematical methods) or with the general methodological and epistemological convictions of the scientist himself, then it is necessary to think of the general structure of the society in that period. Therefore technical analysis of the results and methods used by the scientist is a priori considered and then evaluated within civilization.

On Science. The case of René Descartes (1596-1650) is emblematic in this sense: in his essays *La Dioptrique* and *Les Météores*, Descartes proposes—among other results—his theory of refraction and of rainbow. Every passage of these two works can be explained taking into account: 1) the level of the science in the 17th century; 2) Descartes' experiments and methods; 3) Descartes' use of mathematics; 4) Descartes' philosophical convictions (Hattab, 2009). These books could be understood without taking into account the social non-scientific context in which Descartes lived. The situation as to the *Principia philosophiae* is different at all: we will see in the final remarks of this paper that many results and argumentative structures exposed by Descartes in his *Principia* can be explained taking into account Descartes' epistemological and philosophical convictions, but other parts of the book and some reasoning that appear tormented and unclear can be clarified only considering the particular social situation in which Descartes lived and operated. The sociological analysis becomes hence interesting and can represent a great means to understand the evolution of the scientific ideas only if it is based on the examination of the theoretical-technical results obtained by the scientists and explained in their works. The case Newton and his *civilization science* (Buchwald & Feingold, 2011) is as interesting as the

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