PRACTICES OF MATHEMATIZATION

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Mathematization – both as a historical and a epistemic phenomenon – is commonly understood as the application of mathematics to natural, technical, societal objects. Such an understanding raises a number of questions: what mathematics is applied, what does application involve, what does this application of mathematics produce? Is the mathematics some kind of ready-made that can be pasted upon non-mathematical objects producing specific interpretations of mathematical structures without essentially altering them? Or does the process of application involves transformations of mathematical conceptions resulting in new modes of mathematical reasoning? In other words: what does it mean to develop mathematics in natural and other domains and how is this brought about?

In this paper I will approach this subject-matter from a historical perspective, in particular that of early-modern history of science. From this perspective the above questions become even more pressing because our modern conceptions of mathematics, application, etc. did not exist. The distinction of pure and applied mathematics is a nineteenth-century invention. Prior to the rationalizing strategies of Lagrange, Cauchy and the like, mathematics had an emperical basis that is best exemplified by the early-modern concept of 'mixed mathematics'. In such diverse fields as mechanics, optics, navigation, surveying mathematics was pursued rather than imported from some external domain of pure mathematics. Mathematics was a broad domain of heterogenuous mathematical pursuits, the stratification of which still needs historical clarification. In the meantime, the sixteenth, seventeenth and eighteenth centuries witnessed a tremendous spread of mathematical practices. Mathematical reasoning entered countless new domains of inquiry and invention: heavenly and terrestrial motions, streams of airs and fluids, the nature of light, chance, ships, and so on, and so on. It is not without reason that mathematization has been regarded as a defining characteristic of the Scientific Revolution. The question is how this proces of mathematization took place. I will confront this question by looking at a few historical instances of mathematization.

For example Christiaan Huygens' wave theory of light (1677), in which he developed a mathematical structure for the motions of ethereal particles that account for light. I will argue that, in effect, he managed to introduce mathematical reasoning in the natural philosophical domains of light physics. I will further argue that this mathematization consisted of the extension of his prior pursuit of geometrical optics – the analyses of light rays refracted in lenses – towards questions of the physical nature of light. Mathematization, in other words, consisted of the transfer of a mathematical practice to a new domain of natural inquiry. Likewise, Charles-Augustion Coulomb succesfull determination of electrostatic and magnetic forces (1787) consisted of a transfer of mathematical practices to new domains. Coulomb built upon his experiences as engineer and instrument designer when confronting the experimental philosophical question of the measure of electricity and magnetism. In so doing he went beyond the Newtonian mode of elementary analysis of forces by developing a material model of his analysis, the torsion balance.

Such transfers of practices also entail transfers of knowledge claims. Early modern mathematics, natural philosophy, engineering, each had their own conceptions of the truth, range, foundation and purpose of knowledge and a transfer may also imply the introduction of foreign conceptions. Huygens developed quite a novel conception of natural philosophical truth in his wave theory of light, privileging comprehensibility rather than certainty. Exploring circulation of practices between knowledge traditions (in a Kuhnian sense) I will try to develop a historically informed understanding of mathematization in inquiry and invention.