

CESARE MAFFIOLI, *La via delle acque (1500–1700). Appropriazione delle arti e trasformazione delle matematiche*. Series: Hyperchen: Testi e studi per la storia della cultura del Rinascimento (volume 4). Florence: Leo S. Olschki, 2010. 352 pp. 28 b/w ill. + 1 colour ill. €43.00. ISBN 978-8-8222-6008-6.

This book, which may in part be considered as the prequel to Cesare Maffioli's earlier study *Out of Galileo: The Science of Waters 1628–1718* (Erasmus Publishing: 1994), provides us with an informative and intriguing account of the science of waters in sixteenth and seventeenth century Italy. This book is the fourth volume in a new series, *Hyperchen: Testi e studi per la storia della cultura del Rinascimento*, of the Italian publishing house Leo S. Olschki. Maffioli's protagonists are Giralamo Cardano (1501–1576), Benedetto Castelli (1578–1643) and Domenico Guglielmini (1655–1710)—and to a lesser extent Da Vinci, Tartaglia, Benedetti, Patrizi and Galileo. As the wealth of this book makes it difficult for any reviewer to provide a complete overview of its contents, I will focus on some of its central themes and claims. To this I might add that throughout the book Maffioli's analyses are carefully contextualized and thoroughly based on the relevant primary sources.

During the sixteenth and seventeenth century, mathematics became increasingly dominant in a plethora of knowledge domains. In this book Maffioli focuses on how mathematics transformed the study of the science of waters (p. xiv). Maffioli considers the mathematization of the science of waters as a representative, or as he calls it 'an emblematic', case-study, which has relevance for our understanding of the overall macro-process during which the empirical world was mathematized. Special attention is given to the interaction between philosophers, mathematicians and engineers, between science and art, and between the natural and the artificial. At the outset of his book, Maffioli grants that labelling figures such as Galileo as 'engineer-scientists' is to some extent explanatory insofar as it highlights how engineering practices were in some respects constitutive of their science. However, at the same time such labels are also misleading because they neglect 'the tensions and conflicts between engineers and mathematicians' (p. viii, cf. pp. xi, 13, 17–20). Scrutinizing these tensions is one of the main scholarly endeavours of *La via delle*

acque. Not only were mathematicians entering domains traditionally reserved for (Aristotelian) philosophers, they were also penetrating realms which traditionally fell under the competence of engineers and technicians (cf. p. 19). As an illustration of this, in Chapter 5, entitled 'Politico e scienza dei fiumi', Maffioli analyzes the controversy between Ferrara and Bologna on the diversion of the river Reno and he discusses the interaction between the political authorities, on the one hand, and the engineers, philosophers (e.g., the Jesuit Nicolò Cabeo) and mathematicians, on the other, in the course of this debate.

As I have indicated, Maffioli centres his study around three protagonists who embody different stages in the transformation and mathematization of the science of waters. In his encyclopaedic work, Cardano dealt with the mechanical arts insofar as they had relevance in scientific practice and theorizing: he classified them and at the same time he explained the ratios of several machines *more geometrico* and he also investigated their causes by their effects—in other words, he gave a 'philosophical' interpretation of the machines under consideration (pp. 61, 75). In order to provide a mathematical description of these machines and devices, Cardano 'stripped them from their corporality (fisicità)' (p. 88). He also began to evaporate the Aristotelian distinction between nature and art: for he considered the motion of water by machines, not as violent motion, but as natural motion (pp. 67–68, 73, 75). Castelli is the second protagonist and he developed what can be considered as a Galilean perspective on the science of waters, i.e. he developed an abstract mathematical account based on physico-mathematical principles (p. 182). In this context, Castelli mathematically treated rivers as the summation of an infinite series of parallelepipeds of equal volume but with different bases (p. 183). He also established the following general relation between the relative velocities and areas of two vertical sections of a river: $\frac{\text{relative velocity at A}}{\text{relative velocity at B}} = \frac{\text{area of B}}{\text{area of A}}$ where A and B are two vertical sections of a river and A is the largest of those sections (pp. 187–8). Armed with his physico-mathematical treatment of the motion of rivers, Castelli began to highlight the weaknesses in the technical knowledge of the engineers (p. 194ff). As we have seen, characteristic of the Galilean approach is the abstraction from material circumstances and accidents (cf. p. 326). Our last protagonist, Guglielmini, endeavoured to make the science of waters more 'realistic' (p. 290). From this perspective, Guglielmini was highly concerned to get abstract mathematics more in touch with he himself called the 'sphere of verisimilitude' (*ibid.*). He also introduced several micro-explanations in the science of waters. Guglielmini's endeavours point to an important dynamics: not only was reality mathematized, mathematics also had to be rendered more 'realistic'. In this sense, Maffioli argues, Guglielmini added a naturalistic dimension to the mathematization of the science of waters (cf. p. 326).

To summarize: in *La via delle acque* Maffioli presents us with a new account of the interaction between mathematicians, philosophers, artists and engineers on the basis of a scarcely studied knowledge domain. Although Maffioli himself carefully eschews generalizations, I suspect that his account has the potential to inspire similar studies in different domains. This is a most welcome and competent contribution to Renaissance studies and to the study of Early Modern science. Given its clear merits, I hope that it will not take very long for this book to reach the English reading scholarly world as well.

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