Guidobaldo del Monte*

Maarten Van Dyck

Abstract

Guidobaldo del Monte (1545 – 1607) was one of the most prominent Italian mathematicians from the second half of the sixteenth century. He published influential texts on Archimedean mechanics and perspective that contributed substantially to a better understanding of the mathematical foundations of these sciences. He was also one of the most important patrons of the young Galileo.

Biography

Guidobaldo del Monte (Pesaro, 11 January 1545 – Pesaro, 6 January 1607) was one of the most prominent Italian mathematicians from the second half of the sixteenth century. He was a nobleman from the Duchy of Urbino, and occupied a central position at the courts of the Dukes Guidobaldo II and Francesco II della Rovere for large part of his life, until he fell out of favor in the 1590's ([7] is a recent source that gathers all available biographical information). He studied at the University of Padua, but he probably received most of his mathematical education from Federico Commandino at court in Urbino. He combined practical work as an architect, designer of instruments, and surveyor of fortifications (see numerous contributions in [3]), with theoretical works on astronomy, perspective and mechanics. In cosmology he appears to have been an orthodox Aristotelian, as judged by his reaction to the supernova of 1604 [4, 8]. Notwithstanding this latter position, he was also one of the most important patrons of the young Galileo. Together with his brother, Cardinal Francesco Maria del Monte (well known for having been a patron of Caravaggio), he helped Galileo secure his first teaching positions at the University of Pisa (in 1589) and Padua

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(in 1592) [13]. Around this period, Guidobaldo and Galileo also collaborated on an experiment, recorded in Guidobaldo's notebook, that can be seen to have contained the germs of Galileo's revolutionary new science of motion by showing that the trajectory of projectiles is approximately parabolic [11].

Innovative and Original Aspects

Guidobaldo's most important books were the *Mechanicorum Liber* from 1577 (with an Italian translation supervised by Guidobaldo in 1581), the *Paraphrasis* from 1588, and the *Perspectivae Libri Sex* from 1600. He also prepared Commandino's edition of Pappus' *Collectiones Mathematicae* for printing in 1588, after the former's death (see [12]).

The *Mechanicorum Liber* was probably the most influential treatises on mechanics of its time (see [9, 6] for some reflections on its place in the history of mechanics). It carried out in detail an idea taken over from Pappus (and, through Pappus, Heron of Alexandria): to reduce the operation of the so-called simple machines (lever, pulley, axle in a wheel, wedge and screw) to the law of the lever. He gave careful and rigorous treatments of the first three (though the discussion of the axle in a wheel is somewhat hampered by the fact that Guidobaldo had no way of dealing with a bent lever, or equivalently, forces applied in another direction than the weight of bodies), but he had to limit himself to qualitative statements regarding the wedge and screw (a problem aggravated by the fact that he lacked a satisfying treatment of the inclined plane, which played a crucial role in the analysis of both instruments). Importantly, Guidobaldo put the concept of centre of gravity, as defined by Pappus, at the foundation of the science of mechanics. This led him to an extensive discussion on the possibility of what is currently called indifferent equilibrium, which arises when a body is suspended in its centre of gravity: it will remain in any position given to it. This possibility had been denied by earlier authors (such as Jordanus, Tartaglia and Cardano), who were severely criticized for this by Guidobaldo (see [5, 14, 7, 10] for discussion). Partly in reply to some criticisms on his book, he published an extended commentary on Archimedes' text on the equilibrium of plane figures in his 1588 *Paraphrasis*. This text was the first printed in-depth analysis of Archimedes' proof of the law of the lever in modern times (see [16, 15, 7]). Guidobaldo's texts on mechanics provided an original synthesis of existing ideas and treatments, which actually created what is often

referred to as the Archimedean tradition by showing how to conceptually integrate Archimedes' highly abstract mathematical demonstration of the law of the lever with an analysis of actually operating machines.

Guidobaldo's book on perspective was similarily directed towards foundational issues underlying an established practice. He was the first to give a satisfying and general mathematical treatment of the fundamental principles underlying perspective constructions [1, 2]. The core of his innovation consisted in a rigorous establishment of the concept of a general vanishing point for any set of parallel lines – even if Guidobaldo might not have realized the full generality of his results.

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