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Abstract

Reviewed Title: *Galileo's Muse: Renaissance Mathematics and the Arts* by Mark A. Peterson. Cambridge, MA: Harvard University Press, 2011, 336 pages. ISBN 9780674059726.

Keywords

book review, Mark A. Peterson, Galileo's Muse, renaissance mathematics

Disciplines

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GALILEO'S MUSE: Renaissance Mathematics and the Arts by Mark A. Peterson. Cambridge, MA: Harvard University Press, 2011. vi + 336 pages, index. Hardcover; $28.95. ISBN: 9780674059726.

A standard yarn told by science teachers about the Scientific Revolution is that it was born from the union of experimentation and quantification. This new approach to natural philosophy is typically credited to the heroic efforts and monumental accomplishments of Kepler, Galileo, and Newton, done in the face of reactionary opposition from dogmatic philosophers and narrow-minded theologians. Galileo's transitional role in this narrative is twofold: (1) he is the one who stood up to the church on behalf of science with his advocacy of Copernican astronomy; and (2) he is the one whose scientific approach turned away from Aristotelian forms of causal explanation toward the functional (quantitative) descriptions of modern physics.

This nutshell description contains nuggets of truth, though readers of this journal will likely know ways in which it should be trimmed, qualified, and even rebutted. Historians have long argued over how to contextualize and conceptualize the contributions of seventeenth-century scientists. The present book, modestly priced and carefully edited, makes a fresh and important contribution to our understanding of Galileo, one of the most fascinating and seminal characters of this time period.

Peterson's earlier research focused on connections between mathematics and art in the Renaissance era. With this book, he has moved forward to explore ways in which this sort of material influenced Galileo's scientific work. Historians have, for the most part, investigated possible relationships between Galileo's theories and precedents in medieval natural philosophy, but not in the humanities. Peterson's alternative line of attack is intriguing and breaks new ground. Given that his primary preparation is not in history of science, he is a bit careful in how he formulates his conclusions, but this does not deter him from offering unconventional views on the subject. One nevertheless senses that Peterson strives to "live in" the characters and trends he is writing about. Moreover, his technical training in physics more than qualifies him to evaluate those aspects of Galileo's thought that he focuses upon—Galileo's mechanics and kinematics in his *magnum opus*, *Two New Sciences*, published in 1638, a few years before his death.

While many think of the clash between science and religion whenever Galileo's name is mentioned, that episode receives scant attention here. In fact, Peterson postpones raising this issue until the *Epilogue*, where he offers his assessment that the conflict's importance in Galileo's life and legacy is overblown and distracts from recognizing Galileo's true significance to science. Galileo certainly had a strong interest in astronomy, but it was not a professional one, and the evidence that he initially thought best-demonstrated the Copernican stance on the earth's movement (the tides) he later came to associate with the action of the moon. Galileo's main and lasting contribution to science per se was terrestrial; in his landmark time-squared analysis of falling bodies, he showed how fruitful the combination of experiment and mathematics could be.

Peterson organizes his book into four main parts. In the first part (chapters 1 and 2), after sketching the humanist milieu in which Galileo lived and was educated, he explores the classical Greek and Roman heritage in mathematics available then. The second part consists of four largely independent subparts, each given two chapters: poetry, painting, music, and architecture. Comprising over half of the book, this part examines the various Renaissance arts that had been prominent in the centuries just preceding Galileo. Peterson points out ways in which mathematics entered into these arts and explains how they functioned in Galileo's life and education. After considering aspects of Renaissance mathematics related to the arts, the third part spends one chapter looking at mathematics proper (algebra, geometry, trigonometry) during this time period. The last part finally zeroes in on Galileo's understanding and use of mathematics for his work in science, linking it to the book's previous discussions. As an addendum, Peterson analyzes a thirty-four-page oration given by a student and close follower of Galileo in 1627 upon assuming the mathematics professorship at Pisa. This chapter tantalizingly suggests that the ideas and perhaps even the words themselves are due to Galileo, thus providing us with an additional window on Galileo's view of mathematics, the arts, and their relevance to doing science.

Looking at the sort of mathematics used in *Two New Sciences*, it quickly becomes clear that Galileo is not drawing upon contemporaneous developments in mathematics proper—there is no algebra, no trigonometry, and no incipient calculus. The mathematics

Galileo draws upon heavily involves ratio and proportion, a topic Galileo had been interested in from his earliest study of Euclidean geometry and also the most prominent part of mathematics used by Renaissance artists in painting (perspective), music (scales and tuning), and architecture (harmonious balance of components). The missing art in this list is poetry, which housed little or no mathematical thinking. Peterson argues, however, that Galileo's flawed mathematical analysis of Dante's inferno in *The Divine Comedy*, presented in two serious but whimsical Florentine lectures connected with his appointment as professor of mathematics at Pisa in 1589, may have become a behind-the-scenes stimulus for his eventually correct work on the strength of materials, the first of Galileo's *Two New Sciences*.

But perhaps even more important to Galileo's way of using mathematics was the Renaissance artisans' attitude toward and outlook on mathematics. While mainstream humanists and educators and even Kepler held a view of mathematics that was rooted in more speculative Platonic philosophy and Aristotelian/Ptolemaic practice, Galileo tacitly adopted a more down-to-earth approach. Mathematical features of the world were not dictated by natural philosophy; they needed to be teased out of and made to fit with the way things actually behave, on earth as well as in the heavens. Galileo (and Peterson, to a large extent) attributes this more humble but commanding role for mathematics to Pythagoras and his true followers, allegedly including Archimedes. One might debate whether grounding this modern perspective on mathematization in these ancients is tenable, but it is clear that the changed view of mathematics emerging in Galileo's work and thinking went against the dominant classical viewpoint of his time and signals a new and wide-ranging utility for mathematics in natural science.

Readers may wish to challenge some aspects of Peterson's presentation for accuracy or interpretation, and one can always quibble about how much influence a changed outlook actually had on the derivation of a new result, but *Galileo's Muse* is a provocative and rewarding book. Its thesis is well argued and offers original insights on a topic that has been mined for decades. Peterson's work deserves a spot on the shelf of every academic library and should be read by anyone interested in the Scientific Revolution more generally, or in the nature of Galileo's place and work therein in particular.

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Natural Science

THE ROCKS DON'T LIE: A Geologist Investigates Noah's Flood by David R. Montgomery. New York: W. W. Norton and Company, 2012. 320 pages. Hardcover; $26.95. ISBN: 9780393082395.

As a professor of geomorphology at the University of Washington, David Montgomery specializes in the interpretation of landforms. He is interested in the development of topography and the influence of geomorphological processes, such as flooding, upon ecological systems and human societies. Along the way he became intrigued by folklore about large floods from cultures all over the world. Might there be, he wondered, some basis in geological fact behind such tales? *The Rocks Don't Lie* recounts Montgomery's personal encounter with geological and other lines of evidence that might lie behind the most famous flood story of them all—the biblical flood associated with Noah.

Montgomery tells us that Noah's flood and other biblical stories were treated, in Sunday School, as parables "to be read more for their moral message than their literal words." Implicit in his comment is that the historical content of biblical stories was viewed as relatively unimportant. He was satisfied that "Jesus taught how to live a good life and that science revealed how the world worked." An encounter in his thirties with a devotée of young-earth creationism, however, stirred Montgomery to begin exploring why people accepted the idea of a global deluge. In 1998 he read *Noah's Flood: The New Scientific Discoveries about the Event that Changed History*, a book in which Bill Ryan and Walter Pitman of Lamont-Doherty Earth Observatory espoused the idea that rapid infilling of the Black Sea basin at the end of the ice age might have been the trigger behind the biblical flood story. Montgomery began to realize that the flood story of Noah might have a geologically detectable basis.

Such experiences prompted Montgomery to investigate the history of ideas about the nature, extent, and impact of the biblical flood. Why did early Christians generally accept a global flood? What interpretive strategies did later Christians adopt to adjust to geological evidence that counters a global flood? How have scientific knowledge, Christian faith, folklore, and philosophy interacted throughout the past two millennia? In his search for answers to questions such as these, Montgomery