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The Emperor's New Mathematics: Western Learning and Imperial Authority During the Kangxi Reign (1662–1722)

by Catherine Jami

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REVIEWED BY ALBRECHT HEEFFER

Did you know that Kangxi, the fourth Emperor of the Qing dynasty, reigning over China from 1662 to 1722, was a devoted student of mathematics, and that he compiled one of the largest mathematical works ever printed in imperial China? Nowhere in the East was a king or emperor so involved with the study of mathematics as he was. Although in Europe there have been tsars (Peter the Great) and princesses (Elisabeth, Princess of Bohemia) who had a pronounced interest in science and mathematics, their involvement nowhere matches the dedication and diligence that Kangxi put into his studies.

Kangxi was of Manchu descent and spoke Manchu, a language different from Mandarin. He was the first adult Qing Emperor to rule over China for a long period. His interest in astronomy and mathematics was not inspired by scientific curiosity alone. From early on, he considered Western learning instrumental for establishing his authority over his realm. Jami quotes the Confucian philosopher Yan Yuan, well reflecting the intellectual leaning of that era: "For the Sage, studying, teaching and ruling are one and the same thing." Kangxi recognized that mathematics was essential in order to understand and to rule both Heaven and Earth. The presence of the Jesuits proved helpful for his pursuits. With their mission in China successfully under way since 1582, the Society of Jesus had established itself as a harbinger of advances in Western sciences ranging from anatomy to astronomy and of much needed innovations such as calendar reform. The Jesuits soon discovered that the new physics and mathematics of seventeenth-century Europe, with its applications in land surveying, fortification, ballistics, statics, and hydraulics, was more appealing to the Chinese intellect than the abstract liberal arts of the *quadrivium*. To quote Jami: "These companions of Verbiest partook in a technical culture in fields related to the mathematical sciences, a culture that seems to have given more importance to the production of artefacts than that of texts." Ferdinand Verbiest, a Flemish Jesuit, and his fellow missionaries established themselves firmly within the Astronomical Bureau close to the Chinese center of power, until at some point they were arrested and put on trial because of disputes with indigenous scholars. Thanks to Kangxi, they were rehabilitated and even gained in importance, with Verbiest and later a number of French Jesuits becoming personal tutors to the Emperor.

Jami narrates the whole story and places "the Emperor's new mathematics" in its proper context. The book reads almost like a historical novel rather than a work on mathematics. Yang Guangxian's conspiracies against the Jesuits—the dispute between the Jesuits and Chinese scholars on the correct calculation of the calendar, ultimately arbitrated by the Emperor himself, and Pereira's deliberate sabotage of the mission of the French Jesuits arriving in 1688—are all episodes reminiscent of James Clavell's novel *Shogun*, which was set in Japan.

The 16 chapters of the book are organized into five parts. The first part sets the stage for the introduction of Western learning in China and the role played by the first Jesuits. The second part deals with Kangxi, the Chinese scholar Mei Wending, and the arrival of the six French Jesuits who contributed to Kangxi's initial success in his instrumentalization of astronomical knowledge to assert his authority over Chinese scholars. The third part delves into the details of Kangxi's tutoring in mathematics, with a detailed account of the daily lessons based on diaries of the Jesuits, on the translation of Gaston Pardies's work *Eléments de Géométrie* into Manchu—that book was judged pedagogically better suited than Euclid's *Elements*—and the lectures by Antoine Thomas, a Belgian Jesuit, on arithmetic and algebra. By 1690, the Emperor was able to communicate his skills to his high officials as a learned scholar in the mathematical sciences. The fourth part relates the gradual involvement of Chinese scholars in the production of treatises on mathematics, music, and astronomy. The final part focuses on the work that records the lifelong explorations of mathematics by the Emperor, *Essence of Numbers and Their Principles*. It covered almost 5000 pages and was printed in 1722, shortly before Kangxi's death. The book discusses the Chinese mathematical classics, as well as Western mathematics such as Euclidean geometry, algebra, and the construction and use of mathematical instruments.

Jami's book is a great achievement and an important contribution to our understanding of the science and mathematics of late imperial China. It is an impressive piece of scholarship and research, based on Jesuit sources in Latin and French as well as on texts of Chinese scholars both in Mandarin and in Manchu. Not only did the author make use of rare works but also an abundance of manuscripts, by Jesuits as well as by the Chinese, located in libraries in China, Japan, Paris, London, and Saint Petersburg. Subsequent editions of texts are compared to show how the Jesuits went through successive proposals to solve certain problems, and how their knowledge of mathematics became appropriated as an integral part of the new imperial mathematics.

The book offers too much material to discuss in detail, but I would like to mention two episodes I found

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particularly interesting. The first is the Emperor's study of Euclid. The Italian Father Matteo Ricci had already translated the first six Books into Mandarin in 1607, and at the Emperor's request they were further translated from that version into Manchu. Although Kangxi mastered the propositions of the *Elements* with Verbiest as his tutor, the new geometry that became part of his compendium was rather based on Pardies's treatise, which was critical of the Euclidean tradition. Wooden models were created for the study and calculation of the volume of solids, and Kangxi's interest in Euclid was ultimately limited to practical geometry. In seventeenth-century Europe a similar "physicalization" of mathematics took place, a process in which the Jesuits and their education system played a role.

A second noteworthy development is the kind of algebra that was introduced to the Emperor in 1690 by Antoine Thomas, a Belgian Jesuit. This corresponds to a half-century period after Descartes's *Geometry*, when Leibniz and Newton were developing the calculus, and an elaborate system of symbolic expressions was already in common use. However, the algebra presented by Thomas was based on *cossic* symbolism, developed in Germany during the first half of the sixteenth century. The reason for this may have been that the German Jesuit Christopher Clavius depended strongly on Stifel's *Arithmetic Integra* of 1545 when he published his *Algebra* in 1608. So the algebra taught to the Chinese Emperor did not make use of Cartesian symbolic expressions with x, y, and z or exponents but relied instead on the elaborate and inconsistent system of *cossic* signs that had been in use 150 years earlier! As for linear equations in multiple unknowns, Jami shows a problem that seems to be similar to the ones treated in Buteo's *Logistica* of 1559. Clearly the Jesuits in China were lagging behind the developments in Europe.

I really enjoyed reading Jami's book as a specimen of a new approach to the historiography of mathematics in a cross-cultural context. Today's mathematics is considered universal mathematics, and the common view is that it was the intrinsic superiority of Western mathematics with its highly developed symbolism that made it universal. Jami's study teaches us instead that Western mathematics was shaped through interaction with other cultures, such as that of the Jesuits with Chinese imperial scholars, and could not have gained universality without such a process.

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