

Shen Gua's Empiricism. By Ya ZUO. Cambridge, Massachusetts: Harvard University Asia Center. 2018. Pp. xii + 348. \$49.95. ISBN 9780674987111.

Reviewed by James D. Sellmann
CLASS, Dean's office
University of Guam
Mangilao, Gu 96923 USA

Email: jsellmann@triton.uog.edu

History of science students will want to read this book. Professor Zuo animates the life, career, and thought of SHEN Gua (1031-1095) in this delightful historical, biographical work. SHEN Gua (沈括) embodied the classical spirit of the scholar-official during the Song dynasty (960-1279). Shen is the author of *Brush Talks from Dream Brook* (Mengxi Bitan 夢溪筆談), a canonical text in the study of the history of science in China, and the Notebook (Biji 筆記) style of writing. Zuo argues, using a double-narrative structure, that Shen's intellectual life and career are fused in his scientific empiricism.

This book is a complete study containing a List of Tables and Figures, three pages of Acknowledgments, a List of Abbreviations, a 19-page Introduction, 11 chapters, three interesting and useful appendices, 28 pages of detailed notes, an extensive Bibliography, and a seven-page Index. The third Appendix, *A Selection of SHEN Gua's Writings in Translation* can be found at <http://www.zuoya.org/book> or at <http://bit.ly/2KhmH1> URL links.

In the Introduction, Zuo explains that her approach, rather than writing a biography of a genius, is to uncover the broad and intricate conceptual and historical conditions that shaped Shen's empirical stance based on his decisions concerning what needs to be known and the means to gain knowledge. She begins with a brief critique of early 20th Century propagandist attempts by the Chinese to embrace modernization in their own terms by using Shen's discoveries as evidence of China's earlier discoveries, thereby affirming his apparent superiority. In recorded history, Shen was the first person to discover astronomical refraction, geological erosion, petroleum, and movable-type printing. He studied optics, astronomy, mathematics, chemistry and medicine.

In Chapter 1, "Peripateting the World (1051-1063)," Zuo examines Shen's early life, especially how his humble beginnings and a decade of hardship helped shape his critical view concerning what it meant to be a *literatorus* while facing the harsh reality of surviving in the vast Song bureaucracy.

Chapter 2, "Envisioning Learning," investigates Shen's epistemology. "Things" were getting in Shen's way; he was overburdened by the multi-tasking requirements of his office, but rather than getting lost in things, he turned to study them in detail, developing a hands-on practical approach to study, discovery and invention. He investigated the intricacies of music using a quantitative approach. His early book learning and then his practical learning paid off as he became a Presented Scholar (*jinshi* 進士) in 1063 and started to be promoted in office.

In Chapter 3, "Measuring the World (1063-1075)," we learn how Shen moved to Kaifeng, and was promoted from an associate position in the Imperial Libraries to the policy-

making bureau. Wang Anshi recruited Shen to create sluice gates in the canal to drain the fertile silt into the fields and dredge the canals. The simple tools to measure the canal were insufficient. Shen devised a system of reservoirs that divided the canal into manageable sections, allowing him to adjust the overall altitude of the canal. He applied his quantitative methods to the study of the heavens, reforming the imperial observatory, and making a new calendar. He improved the clepsydra (water clock). He measured the border, using geographic and textual evidence to win a debate against officials of the Liao or Northern dynasty, setting the Song border at Mount Huangwei.

In Chapter 4, “Individuating Things,” Zuo analyzes Shen’s epistemology, distinguishing things first as static objects, and, then, as process relationships. She proposes that this reflects the duality of things, rather than appealing to a nondual interpretation. Her discourse on the thingness of things begins to sound something like Plato’s two world essentialism. She argues that Shen distinguished the thing as substance from our analytical interpretation, using number. She then analyzes number as function, a basic component, and a fundamental operational principle. Shen was an expert reader of the interaction of nature’s yin-yang forces. He understood that the yin-yang forces were processes based on interactional relationships. Zuo proposes that a good analogy for Shen’s view of “things” would be “knots in a net” (p. 83). This allows the number and thing problem to become a practical problem for Shen to solve while he was at the Bureau of Astronomy. Because an eclipse was not predicted using six of the calculation systems, the Five Circulative Courses and Six Qi had to be properly interpreted to reform the calendar. Shen’s reform of the calendar relied on the open-ended or inchoate concept of an “aberration” occurrence. Like a swerve in early Greek atomism, this would generate unexpected change. In concluding the section *Separating Things from Representation*, Zuo, however, sounds like a Platonic dualist when she states, “[y]et to Shen, number (in its three basics) was reality and calendar an artifice; calendrical systems were infinitely insufficient approximation of the deep reality” (p. 98).

In Chapter 5, “Reforming the World (1071-1075),” Zuo introduces Shen’s role as advisor to Wang Anshi. Wang had a broad sweeping vision for reform, and Shen had the practical skills to troubleshoot the implementation issues. In Wang’s famous New Reform movement, Shen made crucial policy decisions. He also helped secure the border; developed military technology, preferring the deployment of archers to the cavalry; devised a new chariot design; and charted a relief map of the Song-Liao border. He also wrote on military tactics and fort construction.

Chapter 6, “Buffeted by the World (1075-1085),” describes Shen’s failed attempts at employing personal influence and their dramatic results. During 1075- 1077, Shen received two rapid promotions, filling the void left by Wang’s resignation in 1074. Eventually, Shen was exiled from the capital. Shen took a balanced “middle-road” (p. 115) approach in developing policies for personnel, currency reform, and salt trade. As practical as these changes were, they went against the spirit of Wang’s recent New Reforms, making Wang look out of step. Shen’s and Xu Xi’s (1025-1082) failed siege against the Xia led to Xu’s death and Shen’s three-year imprisonment in a Buddhist monastery at Suizhou.

Chapter 7, “In the System (and Then Out),” explicates how and why Shen became a nonsystematic thinker. Zou analyzes in detail what systems and so-called systems thinking

entail, using Wang's New Reforms as a model. She argues that it was because of Shen's constant need to seek practical results by applying a trial-and-error experimental-like method and always seeking empirical, observable results, that he was forced to withdraw from both Wang's political system and his ideological systems thinking.

Chapter 8, "Brush-talking the World (1085-1095)," examines the last decade of Shen's life, and the writing and the structure of his famous work. After being released from the Fayun temple in Suizhou, Shen was free to return home, to reflect and write. He completed an old project, a compilation of the maps of the Song territory, entitled, *Atlas of Prefectures and Counties All under Heaven*, and his *magnus opus*, *Brush Talk*. Table 1 outlines the 17 sections, containing the 26 chapters

, of the "Structure of the Modern Standard Edition of *Brush Talk*," arguing that it is not a mere "collectanea of categorized knowledge" (pp. 168-70).

In Chapter 9, "Building a Nonsystem," Zuo explains Shen's empirical approach based on gaining knowledge from "hearing and seeing" by using a literary data collection approach of "written notes" (*biji* 筆記). This notebook style allowed him to reinforce his repeated observations, leading to the development of a kind of reliability or repeatability check; not only where quantified calculations could be corrected but also in mundane human affairs. The chapters on "Precedents" and "Identification and Verification" stress his reliance on reliability, which is needed to establish evidence that a name matches the "thing" being described. Shen's empirical stance and acceptance of the aberration (perhaps what we'd call an anomaly or statistical probability) led him to write *Brush Talks* as a series of practical anecdotes and not as a systematic treatise.

Chapter 10, entitled "Farewell to System," contrasts the system building of the Cheng brothers, Shao Yong (1011-1077) and Wang Anshi with Shen Gua's empirical nonsystem.

In Chapter 11, "Reverberating in the World (1100-1800)," Zuo explains the legacy of Shen Gua and his reforms. Zuo focuses on Shen's impact on three groups: the Neo-Confucian system builders; the seekers of reliability, and the evidential scholars. ZHU Xi sought to absorb the random practical insights of Shen's nonsystem approach into his unifying system. The seekers of reliability enjoyed Shen's evidence-based approach and then used it to scrutinize Shen's own recorded observations, which also influenced textual studies. Some Qing scholars, those who withdrew from officialdom and court intrigue, adapted the evidential based approach to textual scholarship based on Shen's methodology. The chapter ends with reflections on the history of science in China. Zuo concludes, "Shen's findings surely shared some commonalities with modern science, but incidental similarities between a historical subject and modern experience demand even more rigorous efforts in reconstructing the historical context and rendering the idea in its own terms. Such is the central mission I set out to achieve on this book-length journey" (p. 241).

The three appendices offer a value-added component to the book. The first gives a detailed three-page summary of the "*Major Editions of Brush Talks from Dream Brook*." The list is divided into three groupings: the 19 major editions; the 10 editions of the *Supplement to Brush Talks*, and 9 editions of the short work entitled a *Sequel to Brush Talks*. In the second appendix, Zuo provides a comprehensive list of 37 works that represent *SHEN Gua's Other Writings*. "Appendix 3 A Selection of Shen Guo's Writings in Translation" is online at the

above noted URL links. The translations of pertinent passages from four of Shen's treatises, namely, the *Collection of Changxing*, *Efficacious Prescriptions*, *Records of Forgetting and Recollecting*, and *Brush Talks from Dream Brook*. Two passages from the *Collection* show that Shen was a hardworking official with critical and high ideals for officialdom, and the other passage provides a concise interpretation of Buddhism in general. The *Prescriptions* display Shen's practical approach to medicine. We are given three passages from the *Records*: the first describes a recliner-chair; the second describes how and when to plant bamboo; the third gives good reasons to raise snake eating turtles in your garden to get rid of the snakes. Selections from the *Brush Talks* display his critical historical understanding of the rites, astronomical refraction, movable-type, and the discovery of petroleum. These passages show that Shen had a remarkable way of approaching knowledge that led to discovery and invention.

In conclusion, I have four minor criticisms of the book. First, it has tinges of cultural essentialism when it contrasts European and Chinese science. Second, even though Zuo appeals to correlative thinking (p. 92), she falls back into a dualism-based model when she discusses the dual nature of "thing" in chapters 2 (pp. 40-44) and 4 (pp. 77-83). Shen often uses correlative or nondual logic to describe phenomena. For example, Shen's description of the Course-Qi system (pp.84-93) and his description of the relationship between moral-righteousness and personal benefit (*yili* 義利) are correlative or nondual. Zuo would have done better to describe the aspects of "things" and relationships, and "things and representations" in a nondual frame rather than a dualistic one, which begins to border on Platonic-like similarities in her account. Third, in discussing the dual character of "things" and relationships, Zuo used the image of "knots in a net" to represent the connected, net-like, relationship that makes the knots as individuated things, the respective objects they in fact are. Her knotted net reminds me of Indra's Net. She did not explore whether the Jewel Net of Indra and Huayan Buddhism influenced Shen or her own thinking. Finally, Shen's empiricism bears some resemblance to pragmatism and the order of pragmatics. Zuo could have drawn some comparative connections with Shen's approach and pragmatism. Overall, Ya ZUO's work is a commendable contribution to the history of global science, and the history of science in China. It warrants careful study.

Acknowledgments: A special "thank you" is due to Sharon Rowe and Kirill Ole Thompson for their comments and edits that improved this review.