Naturwissenschaften im Kulturvergleich. Europa–Islam–China by Karl Wulff

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This book is a poor attempt to contribute to an old debate: the origins of modern science. It attempts in particular to explain why modern natural science originated in Western Europe as late as the 17th century, and why only there and not in China or the Arab world. The question has become well known as the Needham puzzle [see Needham 1969, Graham 1973]. The book's object of inquiry and title are thus suspiciously close to Toby Huff's slightly earlier work *The Rise of Early Modern Science: Islam, China and the West* [1993]. The same holds for the book's conclusion: it was the neutral institutional space provided by universities and the 'scientific popular masses' [72] which these institutions produced as well as the factors (free inquiry, reason, legal theories, religion, the separation of state and church and Greek philosophy of nature) that led to their establishment that allowed the development of modern science in Europe or the West. Wulff demonstrates that all of these elements were absent in China, and most of them likewise in the Arab world.

From the preface, the reader might expect this book to contain some profound discussions of the nature of science. As the author, a natural scientist in the field of physics, chemistry, and biology, claims:

> I am of the opinion, that only on such a basis, one should write about natural science. [i]

It is, thus, all the more surprising that the book contains only very little mathematics and astronomy, close to nothing about natural science or their precursors, but mostly information on the cultural context of ancient Greece and more than 100 pages concerning the history of Chinese civilization and philosophy, of which the author

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only has a truncated knowledge deriving from recently completed undergraduate studies in Sinology.

The first section of the book, 'The Old Greeks', intends to show the significance of Greek geometry for 'Occidental thinking' [34]. It introduces us to 'the development of rational thinking', 'Euclid and the science of geometry', and the Aristotelean basis of 'our medieval world view'. In this collection of loosely related facts, one also learns about the three basic patterns of creational myths [10], today's conception of the solar system [26–27], the *Timaeus* by Plato, and the work of other Greek philosophers who pursued science more as a 'personal hobby' [71].

Then, the author turns to 'the parallel world', China, his personal hobby. Drawing on the main German language undergraduate manuals in Sinology, Wolff recalls the basics of the language, history, and philosophy of China. He presents China as a culture which differs starkly from 'ours' in everything but ethics. He finally turns to science in China. Although oriented towards 'practical problems', 'since there are singular occurrences of astonishing achievements', he says, 'the Chinese accomplishments in the field [of arithmetic] are indeed worthy of being considered'.[1] Wulff thus devotes altogether four pages to the history of Chinese mathematics and astronomy before turning to speculations about early cultural contacts between Europe and China. A final section on 'Euclid in China' serves as transition to the third part of the book in which the author claims to 'reflect upon the fundamental reasons that hindered the understanding of Euclid in China' [174].

This third part of the book, 'Where is the Difference ?', is constructed around the basic assumption of antithetical attributes, namely, that Greece and China differ in the structures of their societies,

[1] Die Chinesen befassten sich, wie die Babylonier und Ägypter, mit praktischen Problemen. Der Schwerpunkt ihres Interesses lag zudem im Bereich der Arithmetik. Hier waren sie weiter als die Babylonier. Es ist daher durchaus lohnend, sich mit den chinesischen Errungenschaften auf diesem Gebiet zu befassen, da sie hier in Einzelfällen Erstaunliches geleistet haben. Doch auch hier finden wir nur Einzelbeispiele, aber keine allgemeine Struktur eines systematischen Lehrgebäudes. Es gibt viele schöne Steine, aber kein Haus. [155]

their geographies and climates, their religious ideas, their historical developments, their linguistic structures, and their modes of logical thinking. The question of how all this exactly is related to the complex cultural history of the reception of Euclid's *Elements* in China is not answered. Instead, Wulff, argues that scientific genius emerges out of a fusion of mysticism and rational thinking. Thomas Mann's *Doktor Faustus* serves him as an illustration, while the Chinese third century alchemist Ge Hong (葛洪) serves to exemplify another deficiency in China, since he was only a mystic but otherwise 'not interested in nature' [224].

Where one might now expect a separate chapter on science in the Arab speaking world, one finds instead some remarks relating this vast field to European developments within the framework of a conflict between 'Reason' and 'Revelation' and the transmission of Arabic learning to the West. Next comes what is central to Wulff's argument in the book, a discussion of the professionalization of scientists during the development of medieval universities. In these institutions, Wulff argues, Europe could 'produce the human masses educated in science', which then fostered the Scientific Revolution.

The final part of the book, 'Conclusion and Outlook', first reviews the changes in traditional astronomical views which the Scientific Revolution brought about, and then comes back to the initially formulated question, why modern natural science only emerged in Europe. Wulff underlines once more 'the lack of all positive conditions in this [China's] culture that could have allowed such developments' [348]: they had neither Euclidean geometry, nor Ptolemaic astronomy, and there was no broad audience that might have understood what the Jesuits had presented to them. Not only was the rational thinking of the Greeks exotic in Chinese eyes, the Chinese, Wulff believes, had no reason at all to change their traditional modes of thinking.[2] In contrast, Wulff states, the Arabs found absorbing a foreign scientific culture much easier, since 'they did not have an equivalent proper highly developed culture at hand' [34]. The book's epilogue concludes on a moral tone, warning us of the dangers that our modern scientific rational world view is exposed to:

We should preserve and protect this cultural artifact...

[2] That such is certainly not the case in astronomy has been shown in various publications that Wulff has entirely overlooked: see, e.g., Hashimoto 1988.

> the modern scientific world view, based on reason, which is one of the most precious cultural artifacts that Europe—and only Europe—has brought about. [357]

I assume it has become clear from the tone of this review that a reader of Wulff's book cannot but feel uneasy with his approach. On the one hand criticizing, Needham for taking a Eurocentric approach to Chinese science, Wulff systematically falls into the pitfalls of dealing with non-European scientific cultures. Instead of studying the Chinese scientific tradition for its own sake, Wulff takes modern science in Europe as the yardstick by which he measures scientific development in China. He then finds neither an equivalent concept of proof[3] nor a comparable degree of formalization or interest in generality[4] in China.

Wulff's comparative approach, based as it is on such externalism, therefore focuses on the prerequisites necessary for the production of scientific knowledge and technological progress as observed during the Scientific Revolution in Europe, and on the absence of these prerequisites in China. Sivin's critique [1982, 93–94] of Needham's above mentioned puzzle was precisely to show that the absence of a certain development cannot be described with the tools of the historian. The merit of Needham's puzzle though is that he additionally asked why from the first until the 15th-century Chinese civilization was more successful than Europe in exploiting human knowledge about nature for practical needs. He emphatically underlined the Chinese scientific and technological achievements, which are surveyed in his

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[3] Eine vergleichbare Unterscheidung zwischen der Wahrheit einer Aussage und der Schlüssigkeit eines Beweises hatten die Chinesen nicht. Vor allem fehlte ihnen das Konzept eines *Beweises*. [217]

[4] Allerdings waren auch Argumente in Form eines aristotelischen Syllogismus den alten Chinesen nicht fremd. Sie verwendeten sie aber nur ‚unbewusst' in konkreten Fällen. Ihnen gelang nicht der Schritt hin zur Formalisierung und Systematisierung eines Argumentationsschemas. [218]

> Die Griechen unterschieden streng zwischen der Meinung (*doxa*) und dem gesicherten Wissen (*episteme*). Diesen Unterschied kannten die Chinesen nicht. Die alten Chinesen hatten auch keinen Sinn für ein Anhäufen von Wissen um der reinen Erkenntnis willen. [219]

multivolume encyclopedic project on Chinese science and civilization [1954–2004].

The very concepts of 'Europe', 'Islam' and 'modern science' have already been subject to a fundamental critique by such historians of science as George Saliba in his discussion of Toby Huff's approach [http://baheyeldin. com/history/george-saliba-1.html] or Roger Hart [1999] more generally concerning the historiography of Chinese science. Although Wulff devotes a short chapter to the 'Greek Islamic heritage', he does not question his own use of these categories.

Finally, a word on the bibliography. The author has not read any primary sources but relies entirely on secondary research in Western languages. This is not an *a priori* deficiency, but it does become problematic especially since he ignores most of the recent scholarship with respect to the history of Arabic or Chinese science. The latter is a field that has seen a tremendous expansion and historiographic reorientation during the last two decades. Wulff ignores this and cites only his own six page article in the *Bulletin of the German China Association* [1999] as the major 'extensive presentation' of the image of China in Europe nourished by the Jesuits in France and Germany during the Enlightenment. But numerous recent publications give new insights into the many facets of the cultural history of science analyzed from within China. As for the mathematical writings in China for example, the specific theoretical aspects of algorithms and the role of commentary have been analyzed in detail [see Chemla and Guo 2004, Bréard 1999]. And the work of Catherine Jami and others[5] has contributed largely to our understanding of the role of the Jesuit missionaries in the scientific exchanges since the late 16th century, not to mention the many Chinese and Japanese researchers who have published important monographic studies and research papers in their own language. Not including their work and views in an ambitious comparative project such as Wulff's cannot but result in an unduly Eurocentric vision of the history of 'modern science'.

[5] See Jami 1990; Jami and Delahaye 1993; Jami, Engelfriet, and Blue 2001; and Dold-Samplonius, Dauben, Folkerts, and van Dalen 2002.

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