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WESTERN LEARNING AND IMPERIAL SCHOLARSHIP: THE KANGXI EMPEROR'S STUDY

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Action and Discourse: Situating Western Learning in Early Qing China

By 1700, the body of knowledge presented in the Chinese works published by Jesuit missionaries during the previous century had come to be referred to as Western learning (*xixue* 西學). These works encompassed most of the fields taught in Jesuit colleges in Europe, including natural philosophy;[2] but not all of them received equal attention from Chinese scholars, for whom they were mostly written. It was in the mathematical sciences—a term that is used here as an equivalent of *lisuan* 曆算, literally "astronomy and mathematics"—and first and foremost in astronomy, that Western learning was known to all those versed in the field. It was also through these sciences that the Jesuits built a niche for themselves in officialdom. Since 1629, some of them worked to prepare a calendar reform under the supervision of Xu Guangqi 徐光啟 (1562-1633), a higher official who was a Christian convert and an advocate of the use of the Jesuits'

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[2] Peterson (1973); Standaert (2001), pp. 689-694.

teachings in statecraft.[3] After the Manchus took Beijing in 1644, Johann Adam Schall von Bell (1592-1666), who had worked on the calendar reform with Xu, offered his services to the newly founded Qing dynasty and was put in charge of the Astronomical Bureau (*Qintianjian* 欽天監). From that year on until 1826—with a four-year interruption 1664-1669—there was at least one missionary among the senior staff of the Bureau.[4] While putting Western learning directly in the service of statecraft, the Jesuits' integration into the civil service in the quality of imperial astronomers identified them as technical specialists who were at best irrelevant as scholars.

It should be noted that the division between what was acceptable and what was not among the learning that the Jesuits had brought to China does not correspond to the modern separation between science and religion.[5] For example, attempts by some Jesuits at obtaining imperial patronage for the publication of their philosophy, including natural philosophy as it was then taught in Jesuit colleges in Europe, failed.[6] Even the mathematical sciences, to which Western learning as adopted by the Qing mostly pertained, never made it into the imperial examination curriculum. In short, whereas in late Ming China, literati versed in what was first called Heavenly Learning (*tianxue* 天學)—which then included all aspects of the Jesuits' teachings—claimed that it should be studied as a whole,[7] during the first decades of the Qing dynasty Western learning put in the service of the Manchu rulers was perceived as a set of techniques for statecraft that did not qualify for the status of scholarly knowledge. This point of view was later expressed in the assessment of the editors of the *Siku quanshu* 四庫全書 (ca. 1782):

> The reigning dynasty, which has restrainedly adopted [the Europeans'] skills (*jineng* 技能) while prohibiting the spread of their learning (*xueshu* 學術), possesses deep insight.[8]

On the other hand, the late Ming and early Qing period (seventeenth century) is often described as an age of renewal and rehabilitation for the mathematical sciences. According to some intellectual historians, this was followed, in the mid-Qing period (eighteenth century), by their integration into evidential scholarship (*kaozhengxue* 考證學).[9] Most historians of science share this analysis: while

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3 Hashimoto (1988); Jami et al. (2001).
4 Standaert (2001), pp. 719-721.
5 Standaert (2001), pp. 703-704.
6 Jami (2005), pp. 212-221.
7 Standaert (2001), pp. 692-693.
8 SKQS 3, p. 709; see Gernet (1982), p. 85.
9 Elman (1984), pp. 37-85.

they link the renewal of the mathematical sciences to the Jesuits' introduction of new knowledge from Europe, they have argued that subservience to evidential scholarship was detrimental to innovation in those sciences, as attention focused on textual and historical research.[10]

The narratives of intellectual history and history of science on the one hand and that of Western learning on the other hand need to be articulated. In order to do so, let me introduce a distinction that helps make sense of the complex phenomena that we nowadays subsume under the word "science". On the one hand, what we might call the sciences were commonly viewed in China as a set of techniques, practised by low-ranking professionals in the service of statecraft: the calendar, surveying applied to the making of maps or to water conservancy, are examples of this. They involved outdoor activities and the use of instruments. Their products were not discursive texts, but instead data, algorithms, instruments and the organisation of information so as to enhance control over the world out there—heaven, earth and man, to use terms familiar to Chinese scholars. To this I shall refer as "science as action". On the other hand, some literati regarded the sciences as a branch (or as branches) of scholarship, worthy of their attention, and possibly relevant to other fields of scholarship, such as history. Their practice of the sciences involved the study of written texts as much as, or more than, direct observation of, and interaction with, the world out there. I shall refer to this activity, the product of which was typically new texts—in accordance with their claim that they were engaged in scholarship, as "science as discourse". If we distinguish between these two kinds of practice, the narrative of Western learning outlined above recounts how "science as action" was put in the service of the newly founded dynasty in 1644, while the narrative of intellectual history and history of science follows the unfolding of "science as discourse". The two narratives are not incompatible: they merely address two distinct albeit interrelated phenomena, whose interactions need to be better understood. I have argued elsewhere that during the Kangxi 康 熙 reign (1662-1722) the Manchu state in general and the emperor in particular, secured the monopoly of "science as action", leaving "science as discourse" to Chinese scholars.[11]

This monopoly, however, is only one side of the coin: Kangxi's long-lasting interest in the sciences also entailed their study, and resulted in the publication of works of imperial scholarship. In this respect the emperor can be seen as merely following the trend that both historians of science and intellectual historians regard as characterising the period. But the converse possibility should also be considered: given the influence of imperial patronage on scholarship and the Chinese representation of emperors as Confucian Sages to be emulated, to what

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[10] See e.g. Horng (1993), p. 180; Engelfriet (1998), p. 446.

[11] See Jami (2002). Admittedly, the borderline between "science as action" and "science as discourse" is sometimes fuzzy. The opposition proposed here should not be treated as a rigid model, but aims at providing a heuristic tool to approach "science", in particular as practiced and patronised by the emperor.

extent and in what ways did Kangxi's ostentatious interest in the sciences shape the intellectual trends of his time, and how has it conditioned historians' understanding of these trends?

As a prerequisite to answering this broad question, the present article seeks to characterise imperial engagement in "science as discourse". It shows Kangxi as a student, a scholar and a teacher of Western learning—three roles defined by the model of classical Chinese learning. The Jesuits in his service produced a particular version of Western learning for imperial use; this use itself will in turn be illustrated by an example of Kangxi's "investigation of things" (*gewu* 格 物). Finally, the production of "science as discourse" under imperial supervision will be discussed.

It should be noted, however, that the emperor was not alone in his time in promoting the study of the mathematical sciences. A number of Chinese scholars versed in them also argued that they were worthy of literati's attention. Mei Wending 梅 文 鼎 (1633-1721), the most famous of such scholars, advocated this study repeatedly and in strong terms:

> Someone asked Master Mei:
> "Is calendrical astronomy (*lixue* 曆 學) really a matter for a scholar (*ru* 儒)?"
> "Indeed. I have heard that if one comprehends heaven, earth and man, then one is called a scholar.[12] And how could it be that having heaven above one, one did not know its height?"
> "A scholar's knowledge of heaven is the knowledge of its principles; and that is all. What use has he for calendrical astronomy?"
> "Calendrical astronomy is numbers (*shu* 數). There are no principles outside numbers, and there are no numbers outside principles (*li* 理)."[13]

Mei Wending's argument here is epistemological: numbers—that is mathematics—are the key to the proper understanding of the cosmos, and more specifically of the heavens. As such numbers are indispensable to anyone who is striving to be a scholar: he uses the term *ru* 儒, which has moral as well as intellectual and social connotations. In fact very few of those who were regarded as *ru* by their peers at the time would have met his standard. Such assertions on the importance of the mathematical sciences are found in the writings of other scholars versed in them and in the prefaces that were written for their books. However, the existence and location of these assertions are in themselves a clue: no writing on the

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[12] This is a reference to Yang Xiong's 揚 雄 (53 BC-18 AD) *Fa yan* 法 言 (Words of guidance): "Tong tian, di, ren yue ru 通 天 地 人 曰 儒" ("Those who understand heaven, earth and man are called scholars.") *SKQS* 696; p. 346.

[13] SKQS 794, pp. 103-104; See Zhang (1994), pp. 132-136.

Classics would ever call for such legitimation, for everyone agreed that it was the affair of scholars to study the Classics. That one does not find much overt opposition to Mei's point of view in writing does not mean that it was put into practice: ignorance—in both senses—of the mathematical sciences seems to have remained the rule rather than the exception among high officials and scholars not only during the Kangxi reign, but throughout the whole Qing dynasty.[14]

Imperial Scholarship: Classics and Histories

Through his more than fifty years of personal rule, the Kangxi emperor succeeded in turning himself into the patron of all scholarship. It was under his reign that Beijing became the centre of Qing imperial scholarship; it gradually attracted some brilliant Chinese scholars, especially but not exclusively from the Jiangnan area, where academies (*shuyuan* 書 院) functioned as centres of teaching and discussion. Putting Chinese literati in the service of the Manchu dynasty was a means to reconcile them to their new rulers; in this respect Kangxi's policy can be regarded as a long-term success.

The most famous editorial project set up by Kangxi along those lines was the compilation of the official Ming History (*Mingshi* 明 史), which started in 1679 and was completed only sixty years later under his grandson. In the Chinese tradition, the task of compiling the records of the previous dynasty into an official history fell to the rulers of a newly established dynasty. To this effect, an edict was issued in 1678, asking officials to nominate candidates for a special examination to be held in the Palace. By personally examining the candidates, the emperor selected those who received the title of "profound scholars of vast learning" (*boxue hongru* 博 學 宏 儒). This was effectively a shortcut on the path of civil service examinations. Some of the most eminent scholars recommended declined taking part in the examination, thus conveying their refusal to serve the new dynasty; some of their disciples, on the other hand, attended it. In this respect it was a mitigated success. Nonetheless fifty successful candidates were made Hanlin academicians, and the first compilers of the Ming History were appointed among them.[15]

Another use that the emperor made of scholars who passed examinations was to employ them as his tutors. The study of the Classics had long been part of Chinese emperors' education. In the Ming, ceremonial Lectures on the Classics (*jingyan* 經 筵), during which the emperor discussed them with eminent officials, were held twice a year (once in the spring and once in the autumn). The Shunzhi

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[14] Relying on the study of examination questions, Elman argues that Qing officials must have been rather less versed in the sciences than their Ming predecessors; Elman (2000), pp. 461-485.

[15] Wilhelm (1951); Kessler (1976), pp. 157-166.

順 治 emperor (r. 1644-1661) took these up. He also established Daily Tutoring (*rijiang* 日 講), which took place in two sessions during the year; each session started with a Lecture on the Classics and lasted for about three months. This allowed for actual instruction: the daily sessions enabled the emperor to get real knowledge about what was discussed at the formal lectures. Imperial study had been discontinued during Kangxi's minority; he reinstated both the formal lectures and the informal tutoring in 1670. Three years later he decided that the tutoring should continue all year round.[16] Daily tutoring was further institutionalised in 1677, when he set up the Southern Study (*Nanshufang* 南 書 房), located near his sleeping quarters in the Inner City, otherwise staffed by Manchus.[17] There, a team of scholars selected among Chinese Hanlin academicians were put in charge of Daily Tutoring of the emperor as well as of instructing the imperial princes in the Classics and Histories. Moreover they assisted him in all "literary" matters, which included drafting edicts, setting questions for the metropolitan examinations, but also writing poetry and calligraphy for the emperor.[18]

The lecture notes prepared by these tutors were eventually revised and printed: between 1678 and 1749, "Explanations […] during daily tutoring" (*Rijiang… jieyi* 日 講 … 解 義) were published for the Four Books as well as for each of the Five Classics.[19] Thus, in accordance with the Confucian model of the sage ruler, Kangxi's study resulted not only in his own education, but also in that of the whole empire. It was in keeping with the philosophical stands of the main imperial tutors that these works promoted the philosophy of the Cheng-Zhu school ("Neo-Confucianism") to the status of imperial orthodoxy.[20] Manchu or bilingual editions of several works were prepared: this was part of an effort to create a corpus of literature in Manchu, and to direct imperial instruction towards Manchu officials as well as their Chinese counterparts.

Chinese sources describe the emperor as an active and demanding student. Gradually the format of the tutoring sessions changed so as to leave more space for him to express his own views. The tutors often worked all day—and sometimes day and night—on the texts they prepared for the sessions. In return they were treated with generosity, provided with good food and warm clothing for the winter. Kangxi behaved towards them with great familiarity, ignoring ritual and etiquette.[21] For most of them, the post of Daily Tutor (*rijiang guan* 日 講 官) was the first step of a very brilliant career, during which imperial favour was rarely denied to them.

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16 Kessler (1976), pp. 138-144; Smith (1991), pp. 113-114, describes some tutorials on the Yijing 易 經.

17 Wu (1968); Kessler (1976), p. 143; Bartlett (1991), pp. 30, 47.

18 On the role of calligraphy, see Hay (2005), p. 315.

19 Q*ingshi gao*, pp. 2483, 4221, 4226, 4236, 4244, 4248.

20 Chan (1975).

21 Kessler (1976), pp. 141-142.

Kangxi, Student of Western Learning

About the time when he took up Daily Tutoring on the Classics, Kangxi also started studying mathematics and astronomy with Ferdinand Verbiest (1623-1688), then Administrator of the Calendar (*zhili lifa* 治 理 曆 法) at the Astronomical Bureau. This was a complete novelty: there is no earlier record of a Chinese emperor setting out to systematically learn about these technical subjects. Kangxi later explained what prompted him to undertake this study:

> In the first years of Our Reign, many died following mutual accusations during the Calendar case. In the seventh year (1668), after a calendar [for the following year] with an intercalary month in it was promulgated, the Astronomical Bureau memorialised again, wishing to add a further intercalary twelfth month.[22] Many people talked about this, rejecting the proposal on the grounds that never, since the calendars of Antiquity, had one heard of a year with two intercalary months. The Princes, the Nine Ministers and others examined the issue again and again, but there was no one at Court who understood the calendar. Seeing this with Our own eyes, We felt sick at heart. During the little leisure time left to Us by the many affairs [of the State], We have devoted Ourselves to astronomy for more than twenty years, so that We have taken a view of its broad outlines and will not come to be confused about it.[23]

The events referred to here are the reversal of verdict in what is known as the Calendar Case (*Liyu* 曆 獄). In 1664, Adam Schall, who had been in charge of the Astronomical Bureau throughout the Shunzhi reign (1644-1661), and some of his collaborators were impeached and tried: beside attacking Christianity as a heterodox sect, Yang Guangxian 楊 光 先 (1597-1669) accused the Jesuits of having chosen an inauspicious time for the funeral of one of Shunzhi's sons. This was a lese-majesty crime. The death sentence against Adam Schall that ensued in 1665 was commuted to imprisonment. But five of his Chinese colleagues were

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[22] The text reads: "康熙七年閏月頒曆之後欽天監再題欲加十二月又閏." The intercalary month referred to in the first part of the sentence must be the one in the calendar that had already been issued for the eighth year already published, given that the seventh year did not contain any intercalary month (cf.) Han (1997), p. 14: "En l'an sept (1668), après la promulgation du [futur] calendrier pendant le mois intercalaire […]").

[23] *Yuzhi sanjiaoxing tuisuan falun* 御製三角形推算法論 (Discussion on triangles and computation, imperially composed), SKQS 1299, p. 156.

executed, while Yang Guangxian and Muslim astronomers whom Schall had earlier ousted were put in charge of the Astronomical Bureau. In 1668, the doubts raised by the above-mentioned memorial on the addition of a further intercalary month came to the young emperor's knowledge. Eventually the calendar was shown to Verbiest for examination. The latter's conclusion was that the eighth year should have no intercalary month at all. At the time, Kangxi was fourteen; although he had formally ascended the throne, Oboi 鼇 拜, one of the four regents appointed at Shunzhi's death, still retained power. During the discussions and tests held to decide between the Bureau's officials and Verbiest, the young emperor openly opposed Oboi, who had supported Yang Guangxian. The tests turned to the advantage of Verbiest, and his advice of substituting a new calendar for the faulty one (which had already been circulated throughout the empire) was followed.[24] During the whole procedure, the emperor expressed dissatisfaction with his officials for failing to justify the decisions they made.[25] Oboi fell shortly after Verbiest was put in charge of the calendar.[26]

The passage quoted above suggests that even for the emperor the study of the mathematical sciences did not go without saying: it was justified by the necessity to sort out the affairs of state. This necessity, combined with the lack of competence among Bannermen and Chinese officials, rendered acceptable his recourse to the Jesuits as tutors. It should be noted that the motivations put forward by Kangxi here are a good illustration of his style of rulership: in all affairs he displayed great eagerness to acquire enough competence and to gather enough information to be in a position to exert personal control and arbitration.[27] Whereas classical learning was a means for the emperor of enhancing his own image of a scholar—which was all the more vital for a Manchu emperor, the sciences, conversely, were enhanced by imperial study, which granted them the status of learning.

Although it is difficult to give an extensive list of the subjects studied by Kangxi with his Jesuit tutors, the accounts they left give a wealth of information on some of the topics he studied, and on how he studied them. Little is said on the emperor's study of astronomy itself, while other sciences are listed in some detail: Verbiest recounted how he made sure that "all the mathematical sciences present[ed] some specimen of their skills to the Emperor."[28] In the Jesuits' rhetoric, as put forward for European readership, these sciences were but one step on the way that could lead to the emperor's conversion, and ultimately to that of the whole empire. For that purpose, philosophy was to play a major role. This was later stated explicitly by Joachim Bouvet (1656-1730), one of the five French

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24 Golvers (1993), pp. 58-73.

25 Huang (1991); Chu (1997).

26 Spence (2002), pp. 132-134.

27 Spence (2002), p. 170.

28 Golvers (1993), p. 101.

Jesuits who had been sent to China by Louis XIV as his "Mathematicians" in 1685:

> With some reason, we believed [philosophy] to be of greater consequence than all [our] other [tasks], for there is no better means to dispose minds, especially those of Chinese scholars, to receive the truths of the Gospel than a well written philosophy. And this is what obliged us to redouble our application.[29]

Still according to Bouvet, "the emperor wanted to apply himself [to philosophy] for good, and have it entirely in the [Chinese] language so as to eventually publish it in his empire and leave it to posterity."[30] Obviously, at the early stage of his career in China, the missionary was over-optimistic as to the nature and motivations of the emperor's interest in Western learning: the only part of philosophy as the Jesuits taught it for which Kangxi had a long-lasting interest was medicine. Together with Jean-François Gerbillon (1654-1707), Bouvet started tutoring him in medicine; for this purpose they wrote a number of short essays in Manchu.[31] One of their treatises in that language, a Western pharmacopoeia, is still extant.[32] During the last years of the Kangxi reign, Dominique Parrenin (1665-1741) wrote a treatise on anatomy, also in Manchu.[33] It is unclear, however, whether this was done in the context of tutoring.

A good part of the Jesuits' tutoring of Kangxi consisted in explanations of the making and use of the instruments and devices that they imported from Europe or made for him. Astronomical instruments seem to have played the main role here. However they were not the only ones: Verbiest presented a thermometer and a hygrometer, and so did the French Jesuits a few years later.[34] When Tomé Pereira (1645-1708), a Portuguese Jesuit who worked with Verbiest, taught the emperor to play the harpsichord and built musical automata, he also composed a treatise on harmonics in Chinese, entitled *Lülü zuanyao* 律 呂 纂 要 (Essentials of harmonics); it was based in part on Kircher's *Musurgia universalis*; the emperor later had it translated into Manchu.[35] Thus all the disciplines of mathematics as defined in the scholastic *quadrivium* (geometry, arithmetic, astronomy and music) found their way into the emperor's study of Western learning, in the guise of both gifts and texts composed for him.

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29 Bouvet (1697), pp. 148-150.

30 ARSI Jap Sin 165, f. 100 v.

31 Dong (2004), pp. 69-75; Jami (forthcoming).

32 Hanson (2005), pp. 144-146; Jami (forthcoming).

33 Walravens (1996).

34 Golvers (1993), p. 129; Du Halde (1736), p. 341.

35 Wang (2002), pp. 69-71; Jami (2008), pp. 194-195.

Tailor-made Mathematics: Ancient and Moderns

It was in mathematics taken in a narrower sense that Jesuit tutoring seems to have been most systematic; it was most intensive in the 1690s. Two types of sources document this: a number of lecture notes in Chinese and in Manchu, and diaries and correspondence left by the Jesuits.[36] While supplementing each other, they yield different representations. Thus the subject matters taught are organised according to two different typologies of mathematics in the two types of sources. For the Jesuits, what they taught pertained to geometry—Euclidean and practical—arithmetic and algebra. The terminology of the Chinese lecture notes, on the other hand, yields a twofold division of mathematics. These were assigned to two different teams of tutors: geometry (*jihe* 幾 何) was mostly taught by Gerbillon and Bouvet, in Manchu; meanwhile, Antoine Thomas (1644-1709), whose lecture notes were written in Chinese, was in charge of calculation (*suanfa* 算 法), with Pereira as his interpreter.[37] Algebra was one particular method—admittedly a very powerful one—within the category of calculation.

Matteo Ricci (1552-1610), the founder of the China mission, had relied on the textbooks of his master Clavius (1538-1612) when teaching mathematics in China. Similarly, the tutoring of Kangxi in mathematics drew on Jesuit mathematical education of the second half of the seventeenth century: both Thomas and Gerbillon had taught in Jesuit colleges before leaving Europe. The geometry treatise that the two French Jesuits composed for the emperor was based on one of the many handbooks produced in Europe in the seventeenth century under the title "Elements of Geometry".[38] Authored by one of their confreres, Ignace Gaston Pardies (1636-1673), who had held the chair of mathematics at the Jesuit College in Paris, the work was extremely successful in Europe, where it underwent several editions and reprints up to 1724, and was translated into Latin, Dutch and English.[39]

While reflecting Jesuit education in France, the choice of Pardies' work was also part of Gerbillon and Bouvet's endeavour to promote French interests at court. For them, there was no doubt that what they should teach to Kangxi was French science, that is, what was produced under the auspices of the Paris *Académie royale des sciences*, which was a stronghold of the Moderns, in the protracted and multifaceted Quarrel of the Ancients and the Moderns. Pardies' work is dedicated to the Academicians, and its style is deliberately in rupture

36 Jami and Han (2003) give an overview of the main mathematical manuscripts written by the Jesuits in the 1690s for this tutoring. Landry-Deron (1995) analyses the diaries of Gerbillon and of Bouvet for 1690 and 1691.

37 See Bosmans (1924-1926); Han (2003). Thomas' Chinese does not seem to have been deemed good enough for the emperor.

38 For a list of textbooks, see Karpinski & Kokomor (1928).

39 Ziggelaar (1971), pp. 64-68.

with that of "Euclid and other ancient authors" whom he claims are "difficult and boring". He discarded the axiomatic and deductive style that characterised the original *Elements of Geometry*, which implied lengthy expositions; instead he chose shortness and ease.[40] This can be read as an adjustment to the widening audience of Jesuit colleges in Europe; it also reflects the idea, common among seventeenth-century mathematicians, that clarity is an intrinsic quality of mathematics. Gerbillon and Bouvet not only chose Pardies' textbook, but also claimed that they adopted the Moderns' style in their teaching of philosophy, which relied on a work by the Secretary of the Paris *Académie*.[41]

The emperor approved the choice of Pardies' treatise, deeming it much clearer than the Ricci-Xu translation of Euclid that Verbiest had previously taught him.[42] The Manchu version of the treatise, which is an abridged translation of Pardies' *Elemens*, was completed in 1690; a year later, a Chinese version was completed. As with the Daily Tutoring in the Classics, this was done under the emperor's close supervision: some corrections and comments in his hand are found on an early version of the Chinese treatise.[43] Like its European counterpart, the new treatise took up the title given to Euclid's classic, *Jihe yuanben* 幾何原本. It contains a preface, which according to Bouvet was written by the emperor himself.[44] In it, the superiority of the new treatise over that of Ricci and Xu is emphasised: "In what Ricci wrote, it is difficult to elucidate what comes first and what comes afterwards, because the method of composition was unclear. So [this is] another translation."[45] The emperor was aware of France as a specific source of skill: in 1693 he sent Bouvet back there as his envoy, with the commission of bringing back more Jesuits that he could employ; Bouvet returned six years later with twelve confreres.[46]

In parallel with the two Frenchmen, Antoine Thomas pursued his mathematical tutoring. For this purpose he composed two lengthy treatises.[47] The first one was entitled *Suanfa zuanyao zonggang* 算法纂要總綱 (Outline of the Essentials of Calculation). Its structure followed that of the chapters devoted to arithmetic in a *vade mecum* of mathematics that he had written in Latin before leaving Europe, the *Synopsis mathematica*.[48] However, while the Latin work only gave one example to illustrate each rule of calculation, the Chinese treatise contained a

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40 "Epitre", in Pardies (1673), f. ii r.

41 Jami (2005), pp. 217-221.

42 Jami and Han (2003), p. 95.

43 Liu (1995), pp. 8-13.

44 Bouvet (1697), pp. 144-145.

45 Quoted in Jami (2005), p. 220.

46 Von Collani (2005), esp. pp. 102-111.

47 On these treatises, see Han (2003); Han and Jami (2003); Jami and Han (2003); Jami (2007).

48 Thomas (1685); see Han and Jami (2003), pp.150-152.

wealth of problems for each of these rules. Some of them were drawn from the *Tongwen suanzhi* 同文算指 (*Instructions for Calculation in Common Script*, 1614), the first treatise to introduce written calculation as it was then practised in Europe, which was itself based partly on Clavius' *Epitome arithmeticae practicae* (Rome, 1583), and partly on earlier Chinese mathematical works. Some of the problems in the *Suanfa zuanyao zonggang* evoke subjects that Kangxi discussed with the Jesuits during their tutoring sessions. For example, the following problem is found in the section on the simple direct rule of three:

> Suppose that at a distance of 5 *li* cannon are fired. This can be calculated from the sound of cannon, using a time-checking instrument (*yanshiyi* 驗時儀): one obtains 7 seconds. Now again one hears the sound of a cannon. Using a time-checking instrument to calculate this, one obtains 12 seconds. One asks how far is the place where the cannon was fired. Use 7 seconds as the first *lü* 率, 5 *li* as the second *lü*, 12 seconds as the third *lü*. Multiply the second and the third *lü* by each other, divide by the first *lü*. One obtains the fourth *lü*: 8 *li* and 4/7, which is the distance.[49]

The terminology of proportions found here had been coined by Ricci and Xu Guangqi. Some of it, however, is borrowed from the Chinese tradition: *lü*, a term common in earlier Chinese mathematical works, was thus used to refer to the terms of a proportion. This problem could have been written around the time when, during a tutoring session, the emperor asked "various questions on rain, thunder, the propagation of sound, the pendulum, the compass and the variation of magnet [i.e. of the compass]."[50]

The "time-checking instrument" mentioned here is a pendulum. The emperor had first heard about the pendulum more than fifteen years earlier, when Verbiest had written on ballistics for him, around the time of the Three Feudatories Rebellion; Verbiest called the instrument *perpendiculus chronodicticus* in Latin and *chuixian qiuyi* 垂線球儀 (lit. "instrument with a ball hanging on a string") in Chinese.[51] The term used by Thomas, on the other hand, is closer to that found in the *Huangchao liqi tushi* 皇朝禮器圖式 (Figures of Imperial Ritual Equipment, 1760), a catalogue of imperial belongings which, beside sacrificial paraphernalia, included musical instruments, astronomical instruments and fire arms, where one finds an instrument called *liuhe yanshiyi* 六合驗時儀 (lit. "six

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49 *Suanfa zuanyao zonggang* 算法纂要總綱. Bibliothèque Municipale de Lyon, Ms. 82-90, vol. 1, f. 26b.

50 According to Bouvet, this was on 20 May 1690. See BnF Ms. Fr. 17240, f. 275 v; Landry-Deron (1995), vol. 2, pp. 82-83.

51 Probably in the mid-1670s. See Golvers (1993), pp. 104-105, 410; *ZKJDT/TW*, vol. 7, p. 98.

directions time-checking instrument"; the "six directions" are the four horizontal directions and the two vertical ones).[52] Two such instruments, built in 1744, are kept in the Palace Museum in Beijing; according to Bai Shangshu and Li Di, they are the earliest extant second pendulums.[53] The exact characteristics of the pendulum referred to in Thomas' problem, then, remain unclear. This problem nonetheless illustrates the close relations between mathematics and other subjects in the tutoring received by the emperor. The Jesuits' accounts suggest that this resulted from his demand rather than from their initiative.

Another treatise written by Thomas discussed algebra, a branch of European mathematics that had never been taught before by the Jesuits in China: the term was transcribed as *aerrebala* 阿 爾 熱 巴 拉 in the foreword of the treatise.[54] However, it was the title of the treatise, *Jiegenfang suanfa* 借 根 方 算 法 (Calculation by Borrowed Root and Powers) that gave its Chinese name to the mathematical method described in it: *jiegenfang fa* 借 根 方 法. With more than 100,000 characters the *Jiegenfang suanfa* is the longest of all the mathematics treatises written for Kangxi by his Jesuit tutors known to us. Over a century after Viète had first introduced letters to represent both known and unknown numbers, the Kangxi emperor was taught cossic[55] algebra as it had been practiced and taught in Europe since the Middle Ages, in which the unknown and its powers are represented by abbreviations of their respective names.[56] By and large, the algebra presented in the *Jiegenfang suanfa* is similar to that found in Clavius' *Algebra* (1608). However the Chinese work may well have been composed rather than directly translated from any particular treatise, in a way similar to the *Suanfa zuanyao zonggang*; so far possible European sources for it have not been identified. Algebra was not part of elementary mathematical education in Europe: Thomas had not included it in his Latin mathematical treatise. However he was familiar with symbolic algebra himself, so that his choice to teach Kangxi cossic algebra needs to be explained. One might suggest that, unlike his French confreres, he sided with the Ancients, and chose to perpetuate the mathematics Clavius had taught: as with his borrowing from the *Tongwen suanzhi* this suggests a continuation of the Jesuits' late Ming heritage.

In sum, two different and potentially antagonistic cultures underlay the Jesuits' tutoring of the emperor in mathematics, namely Jesuit mathematical education as designed by Clavius a century earlier and the sciences as patronised by Louis XIV and taught to the sons of European elites in his time. Both cultures,

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52 *SKQS* 656, p. 179.

53 Bai and Li (1984).

54 *Jiegenfang suanfa*. Ms. 39-43, vol. 1, n. p.

55 From "Coss", a term used in German works, which is derived from "cosa", the Italian term for "thing".

56 Reich (1994); Jami (2007), pp. 459-465.

however, were tailored to suit imperial demand, and the resulting textbooks formed a coherent whole.[57]

Kangxi as a Scholar of the Investigation of Things

The emperor's interest was not however restricted to the mathematical sciences. This is apparent from some texts that have come down to us as written by him in person; they were published posthumously as part of his collected prose, the *Shengzu Ren huangdi yuzhi wenji* 聖祖仁皇帝御製文集 (Collected Imperially Composed Works by Shengzu Ren huangdi).[58] The most important of these texts belongs to the *biji* 筆記 (jottings) genre; it is entitled *Kangxi Jixia gewu bian* 康熙幾暇格物編 (Collection of the Investigation of Things in Leisure Time of the Kangxi era).[59] The work contains 93 jottings divided in six sections. Most of the jottings are about natural phenomena, particular places in the Qing empire, animals and vegetables. A partial French translation of the work, published in the late eighteenth century, was entitled "Observations on physics and natural history by Emperor Kangxi":[60] this title suggests what fields the jottings covered according to eighteenth-century European classifications. The "things investigated"—in Chinese terms—as well as what he said about each of them show that for him Western learning was only one among many sources of information. The jotting on thunder is typical in this respect:

> The sound of thunder does not go further than 100 *li*
>
> As to thunder and lightning, Master Zhu [Xi] has discussed them with utmost precision; there is no need to say more. We have checked it by means of calculation: the sound of thunder cannot go further than 100 *li* 里. The calculation relies on the Yellow Bell[61] as standard for the foot (*chi* 尺) and the inch (*cun* 寸), to determine the second pendulum (*yimiao zhi chuixian* 一秒之垂線);[62] whether for length or for weight,

57 Jami (2007), p. 462.

58 The emperor is here referred to by his temple name.

59 See *SKQS* 1299, pp. 566-603; Li (1993). I am currently working on an annotated translation of this work.

60 "Observations de Physique et d'Histoire naturelle de l'empereur K'ang-Hi", in Cibot (1776-1791), vol. 4, pp. 452-483.

61 *Huangzhong* 黃鍾 is the first pitchpipe. It served as the basis for calculating the length of other pitchpipes, being the longest and producing the lowest note (fundamental harmony). It was regarded as the foundation of the definition of length units.

62 The *Siku quanshu* version has 杪 instead of 秒 (*SKQS* 1299: 571).

> there are fixed variations.[63] We have tested this with cannon: as smoke arises they sound forth; the further the sound, the more delayed it is. Having obtained standard proportions, and then calculating the distance of the thunder or cannon, one obtains [it]. Each time we have measured, beyond one hundred *li*, although there was lightning the sound did not reach; thus for the first time We knew the range of thunder. When doing river works, We stopped in Tianjin. Bannermen fired cannon at the Lugou 蘆溝 Bridge;[64] at the time a northwest wind was blowing; the sound of cannon seemed quite close, and they were at about 200 *li*.[65] Using this as a measure that cannon resonate further than thunder is doubtless.[66]

Zhu Xi's 朱熹 (1130-1200) view of thunder and lightning was that they are "mutual rubbing and grinding of *qi* 氣".[67] This was well known to early Qing scholars, so that Kangxi could endorse it without quoting it explicitly. Zhu Xi likened thunder to the explosion of a firecracker; Kangxi's analogy with cannon shot was certainly more martial. While piously asserting that Master Zhu had exhausted the subject, the emperor nonetheless innovated by quantifying the study of sound. Relying on Western learning, he introduced mathematics into the investigation of things. His military analogy is closely related to this quantification: like cannon, lightning and thunder can be perceived independently by sight and by hearing, and it is by measuring the interval between the two observations that one can assess the distance to the place where they occur. Kangxi's reminiscence of the testing of cannon may have dated back to the time of the Three Feudatories Rebellion (1674-1681), when Verbiest cast cannon for him.[68] Thus the emperor derived considerations on thunder relevant to the "investigation of things" from his inspection of military equipment that had been vital to the very survival of the dynasty, rather than from leisurely observation of nature and festivals, or from lengthy study of books. It is also significant that his observation about the sound of cannon was made during one of his many trips of inspection of hydraulic works, to which he gave great importance. The description of the pendulum in the jotting is elliptic: rather than a systematic record of observations, this jotting is an account by the emperor of one of his acting outs of mathematics, typically located in the open air. It was written from memory rather than by referring to any book or written note. Kangxi's investigation of things is experiential rather than experimental. Such experience as he had, however, was probably an

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[63] Kangxi's phrasing seems to put length and weight on a par.

[64] Close to Beijing, to the south-west, so that it is north-west of Tianjin.

[65] 300 in one of the editions.

[66] *SKQS* 1299, pp. 571-572; Li (1993) pp. 14, 84.

[67] Kim (2000), p. 159.

[68] Verbiest described these tests. See Golvers (1993), pp. 105-109.

imperial prerogative. It is unlikely that at the time many officials or scholars closely observed cannon, and carried instruments that allowed the precise measurement of time.

Further evidence that the knowledge displayed in the above jotting was not widely shared amongst scholar-officials is found in a reminiscence by one of them, Li Guangdi 李光地 (1642-1718), of the emperor's description to him of how to make and use a pendulum, during a conversation that took place in 1702:

> His Majesty said […]: "The builder's foot (*yingzao chi* 營造尺)[69] [established] at the beginning of the Ming is actually the ancient foot. At first We did not believe it, so We checked it by the Western method. Set up a frame; there must not be the slightest error in the distance between the four pillars. From the top hang a silver thread, on which hangs a lump of gold; there must not be the slightest error in its weight. If cannon is shot at several *li* or several tens of *li*, as soon as you see the blaze, pull the gold lump then let it go. One out and one back is one swing;[70] count them. As soon as the cannon resounds, stop the lump. Count the total number of swings, or of swings and a half, and the subdivisions in that half. Each swing is a second; sixty seconds are a minute, sixty minutes are a *ke* 刻, eight *ke* are a [double] hour. If the cannon is nearby, it resounds a bit more promptly; if it is far, it resounds a bit more tardily. For each swing, count that the sound of cannon travels seven *li*; no matter the distance at which the cannon is fired, this does not vary in the least. Using this foot to measure the number of *li*, there is not the slightest discrepancy." [71]

Some inaccuracies in this passage suggest that Li Guangdi himself, or the person who wrote down this reminiscence of his—possibly both of them—did not quite understand the matter discussed by the emperor: the number of minutes in a *ke* is given as 60 (instead of 15),[72] and the distance covered by the sound of cannon as 7 *li* per second (instead of 5 *li* in 7 seconds, as given in Antoine Thomas' prob-

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[69] There were three main standards for the *chi* in the Ming period: *yingzao chi* 營造尺 (builder's foot), *caiyi chi* 裁衣尺 (tailor's foot) and *liangdi chi* 量地尺 (surveyor's foot).

[70] The text has *you* 優, which is pronounced like *you* 悠 (swing). Given that the exchange between Li and the emperor was entirely oral, the term used by the latter may well be mis-transcribed here; there is other evidence further in the text that Li did not fully master the technicalities of the conversation.

[71] Li Guangdi vol. 2, p. 813.

[72] In the system introduced by the Jesuits (the one in use in Europe) and in use thereafter in official astronomy, there were 96 *ke* per day (instead of 100 *ke* per day in the previous Chinese system); one *ke* was a quarter of an hour.

lem). Even Li Guangdi, one of the very few high officials—if not the only one—who took Kangxi's injunction to study the mathematical sciences seriously, and became a patron of the mathematical sciences, did not fully grasp the technicalities discussed by the emperor.[73] It should be noted that Li was quite dismissive concerning his own understanding of the mathematical sciences: "Looking at [a] book I can understand; I close the book, and then I forget. There is no other reason to that than my nature."[74] This reminiscence of Kangxi's description of the pendulum and of its use was published among Li's collected prose; no one, including the modern editor of this collection, seems to have noticed the mistake in the units of time measurement. This does suggest that these units were not familiar to scholars—let alone the rate of sound propagation.[75] Nonetheless, in the ensuing dialogue (paraphrased here in modern terms rather than translated literally) Li raised a commonsensical objection, revealing that he did understand what the emperor was talking about: the period of the pendulum's oscillations would vary as its amplitude decreased. To this the emperor replied that the pendulum slowed down as the amplitude of its oscillations decreased, so that the period would remain constant.[76]

In the emperor's words as recorded in Li's memoirs, measuring the time elapsed between a cannon shot and the perception of its sound is a means of measuring distance. Given that there are 1800 feet (*chi* 尺) to a *li*, and taking the rate of sound propagation as a parameter, this in turns allows to test the "accuracy" of the standard *chi*. Kangxi also reports having checked (*yan* 驗) this accuracy against the traditional definition of weight standard units. His whole argument tends towards showing that the Ming standard measure unit was "correct", in that it matched ancient ones. The emperor's approval of the Ming builder's foot is not surprising, given that it was still in use in his time.[77] By his measurements, he enacted the traditional duty of the sovereign to set standards for units. But another point emerges from Li's account: Western learning as monopolised by Kangxi led the latter to commend a unit defined by the Ming dynasty. This is revealing of the classification of knowledge that underlay their exchange: for both of them the objects they discussed belonged together, in a complex continuum of "things to be investigated" that contained "heaven, earth and man", rather

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73 Han (1997).

74 Li Guangdi vol. 2, p. 776.

75 One might also wonder whether Kangxi did not refer to the length of the pendulum among the parameters for which "there must not be the slightest error", or whether Li omitted it from his account. Although the material quoted here gives no evidence that the emperor knew that length alone determines a pendulum's period, his jotting on the sound of thunder does suggest that he was aware that length is the crucial parameter in constructing a second pendulum.

76 Li Guangdi p. 813.

77 Qiu et al. (2001), p. 421.

than to a domain comparable to "physics and natural history"[78] that could be opposed to human history.

Kangxi as a Teacher: the Production of the *Shuli jingyun*

While studying with the Jesuits, Kangxi repeatedly commented on the incompetence of Chinese scholars in the sciences. In the mid-1700s, however, the Rites Controversy led him to distance himself from the Jesuits.[79] Thereafter he actively sought to recruit Chinese scholars specialised in the mathematical sciences. His well known support of the idea that "Western learning originated in China" (*xixue zhongyuan* 西學中源), an idea also championed by Mei Wending, is best understood in this context. It was a way of acknowledging the primacy and universality of ancient Chinese learning, as providing the foundations of the now superior Western learning.[80]

Nonetheless, the emperor continued to make use of the Jesuits' skills in the service of statecraft. Not only did they continue to work at the Astronomical Bureau, but they also surveyed China for the famous *Huangyu quanlantu* 皇輿全覽圖 (known as the Kangxi Atlas, 1708-1718). The project, often said to have been suggested to the emperor by a Jesuit, was a major state enterprise. Supervised by some of them, it was carried out using Western triangulation methods; at the same time, it relied on the huge network of administration that permitted the centralisation of information. This suggests that to the end of his reign, the emperor regarded Western learning (*xixue* 西學) as an important source of technical skills to be used in the service of statecraft—that is, a reservoir of "science as action".

Kangxi's appropriation of Western learning culminated in the compilation of the *Yuzhi lüli yuanyuan* 御製律曆淵源 (Origin of Harmonics and Calendrical Astronomy, Imperially Composed), which took place between 1713 and 1723. Bibliographies attribute authorship to the emperor. He is thus represented as having concluded his reign by bestowing on his empire a body of learning, which was to define imperial orthodoxy in the mathematical sciences. The term *yuzhi* 御製 in the title does convey the emperor's personal intervention at various stages of the compilation. The title also refers to the traditional links between astronomy and harmonics that are apparent, among others, in the *Hanshu* 漢書 (History of the [Western] Han), where the two subjects are discussed in the same mono-

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[78] As in the title of the eighteenth-century French translation of the *Kangxi Jixia gewu bian* mentioned above.

[79] The Rites Controversy mainly related to whether Chinese Christians could continue to observe traditional rituals, such as those showing respect to ancestors. For a brief account, see Standaert (2001), pp. 680-688.

[80] *SKQS* 1299, p. 156; cf. Chu (2003), pp. 206-208.

graph. The title of the mathematical part of the compendium, *Yuzhi shuli jingyun* 御製數理精蘊 (Essential Principles of Mathematics, Imperially Composed), suggests the reconciliation between numbers and principles that Mei Wending regarded as indissociable. Imperial mathematics was attuned with the trends of the time.

The compilation of the *Lüli yuanyuan* resembles both that of the *Mingshi* (Ming History) and that of the "Explanations during Daily Tutoring" series. In 1713 an Office of Mathematics (*Suanxueguan* 算學館) was set up. About forty scholars were recruited after a special examination, in a way reminiscent of the recruitment process for the compilation of the Ming History, more than three decades earlier.[81] As is well known, the task assigned to this office was the compilation of three compendia on mathematics, astronomy and harmonics respectively. The emperor's Third Son, Prince Yinzhi 胤祉 (1677-1732) was appointed as supervisor of the project, assisted by two of his brothers, the fifteenth and sixteenth Princes; all of them had received tutoring in Western learning, including music. The Office was assigned buildings in the Garden of Pervading Spring (*Changchunyuan* 暢春園), an Imperial Villa near Beijing, where the emperor, it seems, spent more time than in the Forbidden City when he was in the capital. There were no Jesuits among the staff of the Office of Mathematics. In fact their correspondence suggests that their relationship with the emperor and with Prince Yinzhi were sometimes rather tense: at this stage, imperial appropriation was, it seems, motivated at least in part by distrust of missionaries. Nevertheless, the latter continued to produce lecture notes.[82] Those they had written in the 1690s were used extensively for the works on mathematics and harmonics.

We do not have an extensive list of the staff of the Office of Mathematics. Besides the selected scholars, it also included craftsmen who made instruments. We do, however, know the names of the most prominent scholars who were engaged in compiling the books. Some of them were protégés of Li Guangdi, who had introduced them to the emperor; most of these had earlier studied with Mei Wending under Li's patronage; Mei's own grandson, Mei Juecheng 梅瑴成 (1681-1763), was among them. Another important collaborator, He Guozong 何國宗 (?-1766), was the son of an official astronomer; two of his brothers were also involved in the project. There were also some Bannermen, in keeping with the imperial effort to integrate technical subjects into Bannermen's education. In that respect Prince Yinzhi—who, like his father, appears to have been genuinely versed in the mathematical sciences—and his younger brothers were role models.

Besides two imperial princes, forty-five contributors to the *Lüli yuanyuan* were listed in 1724, once the work had been printed.[83] On this list their rank and position is as of 1724, so we do not necessarily know what their status was during

[81] Jami (1986), pp. 34-37; *Qingshi gao*, p. 1668.
[82] Jami (1986), pp. 37-42.
[83] *SKQS* 790, pp. 5-7.

the compilation. However an important point appears from the list: only five of those contributors belonged to the Astronomical Bureau. This suggests two things: first, for this project the Kangxi Emperor had recourse to "mathematical talents" among literati rather than to the already trained staff of the Astronomical Bureau. In other words, he recruited scholars versed in *lisuan* for the compilation rather than professionals in astronomy. This is all the more paradoxical as the *Lixiang kaocheng* 曆象考成 (Thorough Investigation of Calendrical Astronomy), the astronomical part of the compendium, was intended to provide the foundations of astronomy as practised at the Bureau. It may explain why, shortly after its publication, the official astronomers who worked there dismissed the methods put forward in this work as inaccurate. Secondly, after the work was completed, most of the compilers whose careers are known to us went on to fill posts in which little use was made of their specialisation. This suggests that, although a few officials owed their career to their skill in the mathematical sciences, this was a consequence of Kangxi's personal interest in those sciences. Imperial institutions had no permanent need for their competence. This again parallels what happened to the scholars in charge of Daily Tutoring in the Classics: the latter position as such was not very high ranking; it was instead a stepping-stone to a very successful official career. In short, contrary to "science as action", "science as discourse" was not produced by specialists, and was not professionalized. This reflects the nature of the imperial project: once the imperial word had been pronounced on the mathematical sciences, there was no need to perpetuate the production of "science as discourse" under imperial patronage.

Conclusion

As the second ruler of the Qing dynasty, Kangxi chose to define imperial orthodoxy in mathematics, astronomy and music as well as in classical learning. Imperial publications played a founding role; they were all the more important as the newly established rulers were not Chinese, and had to conciliate the Chinese elite. As they came from beyond the Great Wall, the Qing had to out-Herod Herod—or rather in this case out-Confucius Confucius. In the light of his general attitude towards learning, Kangxi's study and promotion of the sciences, including Western learning, appear as an attempt to integrate them into scholarship. Given the ritual importance of calendar and music, they can also be seen as part of his embodiment of the Confucian ideal of the Ruler-Sage.

This being said, in the history of China there is only one precedent for an imperial definition of mathematics: that is the compilation of the Ten Mathematical Classics (*Suanjing shishu* 算經十書, 656) at the beginning of the Tang dynasty. In other words compliance with Chinese cultural patterns did not entail the study of mathematics, nor indeed the particular emphasis that Kangxi put on it. Social and cultural factors never explain away personal choices and achievements: rather they provide a relevant framework for interpreting these. Nor are individual considerations enough for a full understanding: while it is obvious that the emperor had a taste for the mathematical sciences, taste alone is no sufficient explanation either. He also had a taste for the harpsichord, for example, but the practice of Western music hardly spread beyond the Inner Court. So we need to go a little further.

When advocating the study of mathematics, the emperor always presented it as the key to mastering a number of technical fields. Besides astronomy and music, these included surveying and cartography, water-conservancy and meteorology. In other words, in mathematics he found a tool by means of which he could get a personal hold on matters regarded as crucial for statecraft. His repeated demonstrations of mastery in these fields were thus as many displays of himself in full control of the Qing Empire. They were typically concluded by edifying speeches on the power of mathematics (*suanfa* 算 法). Thus, combining action and discourse, he enacted the double role of ruler and teacher—the very archetype of the sage ruler. It is at this juncture, I believe, that the provenance of this learning mattered: it was foreign to the officials for whom the demonstrations were intended. In classical learning the emperor usually had to defer to them, as they had been selected on the basis of their scholarship. With mathematics on the other hand, he took them onto grounds on which he knew that he could act as an arbiter and a teacher. And indeed during the compilation of the *Lüli yuanyuan* he acted as both.

One final element can be added to this reading of Kangxi's choice to integrate mathematics into imperial scholarship. This integration could only be fully achieved if mathematics was located within classical learning. The imperial endorsement of the idea of the "Chinese origin of Western learning" served precisely this purpose. As mentioned above the mathematical part of the imperial compendium, the *Shuli jingyun*, is mostly based on the lecture notes written by the Jesuits for Kangxi in the 1960s; these represent a version of Western learning specially produced for his use. However, the *Shuli jingyun* opens with a chapter on the "Origins of mathematical principles" (*Shuli benyuan* 數 理 本 原): these are piously traced back to the mythical foundations of Chinese civilisation, ultimately representing mathematics as stemming from the *Yijing*—as reconstructed by Song dynasty scholars. Thus the ruler who came from beyond the Great Wall, instead of forcing Barbarian learning upon his Chinese subjects, was retrieving the lost learning of their ancient golden age.

In closing, let us return to the distinction between "science as action" and "science as discourse". One can conclude that in the early Qing, the state appropriated Western learning in both these dimensions. Indeed the state presented Chinese scholars with a model in which both dimensions were combined. It seems, however, that the two dimensions thereafter remained addressed by different groups. The eighteenth century integration of the sciences into evidential scholarship may be regarded as the appropriation of "science as discourse" by scholars, while the specialised officials, who continued to work on reforming the calendar and mapping the empire into the Qianlong 乾 隆 reign (1736-1795), continued in possession of "science as action". The use in historical writings of the single word "science" to account for Western learning in the service of the state on the one hand, and for the pursuit of some evidential scholars of the eighteenth century, obscures this divide, which needs to be further explored. It may well be that the Kangxi emperor was the only one to personify a synthesis of "science as action" and "science as discourse" at the time.

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