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The Problem of Modern Science in China in the Last 300 Years: From Ming-Qing to Qian Mu

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Abstract

Until 1900, Ming-Qing Chinese literati interpreted the transition from traditional "Chinese science" to modern, universal scientific knowledge--and its new modes of industrial power--on their own terms. The struggle over the meaning and significance of the specific types of natural studies brought by the Jesuits (1600-1775) and Protestants (1842-95) to China occurred in a historical context in which natural studies in late imperial China were until 1900 still part of a native imperial project to master and control Western views on what constituted legitimate natural knowledge. This process of adaptation went through three stages up to 1900: 1) the Jesuits in China and the assimilation of pre-modern science; 2) the Protestants in China and the introduction of modern science; 3) the denigration of traditional Chinese natural studies and the reasons for its failure. Subsequently, many Chinese intellectuals simply assumed that traditional natural studies in China had not

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amounted to much. Before, during, and after the 1923 "Debate on Science and Philosophy of Life," modern intellectuals such as Liang Qichao, Hu Shi, and Qian Mu were thus faced with the culturally puzzling question of why modern science had not developed in China. Writing after the "Debate on Science and Philosophy of Life," and before Joesph Needham's Science and Civilisation in China project was initiated in the 1950s, Qian Mu reevaluated the reasons why Chinese before 1850 had not valued science. He also considered the future impact that modern science would have on traditional Chinese culture.

The Problem of Modern Science in China in the Last 300 Years: From Ming-Qing to Qian Mu

Benjamin A. Elman

1. The Jesuits and Pre-Modern Science in China

After 1600, the interaction between Chinese and Europeans over the meaning and significance of natural studies was very much contested. Unlike the colonial environment in India, where British imperial power after 1700 could dictate the terms of social, cultural, and political interaction between natives and Westerners, natural studies in late imperial China were until 1900 part of a native imperial project to master and control Western views on what constituted legitimate natural knowledge.[1] Each side made a virtue out of the

[1] On India, see Bernard Cohn, *Colonialism and Its Form of Knowledge: The British in India* (Chicago: University of Chicago Press, 1996), pp. 5-56. See also Gyan Prakash, *Another Reason: Science and the Imagination of Modern India* (Princeton: Princeton University Press, 1999), pp. 3-14, which notes that the British "civilizing mission" in India initiated the cultural authority of modern science in South Asia.

mutually contested accommodation project, and each converted the other's forms of natural studies into acceptable local conventions of knowledge.

Arguably, Europe was already ahead by 1600 in producing basic machines such as clocks, screws, levers, and pulleys that would be applied increasingly to the mechanization of production. But Europeans still sought the technological secrets for silk, textile weaving, porcelain, and tea production from the Chinese.[2] Chinese literati in turn borrowed from Europe new algebraic notations (of Hindu-Arabic origins), geometry, trigonometry, and logarithms from the West. Indeed, the epistemological premises of modern Western science (= *kexue* 科學) were not triumphant in China until the early twentieth century. Until 1900, then, Chinese literati interpreted the transition in early modern Europe--from new forms of scientific knowledge to new modes of industrial power--on their own terms.[3]

Consequently, it would be a historiographical mistake to underestimate Chinese efforts to master on their own terms the Western learning (known as *Xixue* 西學) of the Jesuits in the sixteenth, seventeenth, and eighteenth centuries. Literati scholars and calendrical specialists in the imperial government interpreted Western achievements in natural studies in light of native traditions of scholarship, which they used to evaluate and apply specific Jesuit techniques. Ming (1368-1644) and Qing (1644-1911) dynasty literati learned from the West and integrated this "new" learning into traditional studies by calling it "the investigation of things and extension of knowledge" (*gezhi* 格致 , i.e., 格物致知).[4]

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2 Donald F. Lach, *Asia in the Making of Europe. Volume II. A Century of Wonder, Book 3: The Scholarly Disciplines* (Chicago: University of Chicago Press, 1977), pp. 397-400.

3 See Donald Mungello, *Curious Land: Jesuit Accommodation and the Origins of Sinology* (Honolulu: University of Hawaii Press, 1985), pp. 23-43, and Qiong Zhang, "About God, Demons, and Miracles: The Jesuit Discourse on the Supernatural in Late Ming China," *Early Science and Medicine* 4, 1 (February 1999): 1-36.

4 See Hsu Kuang-Tai (Xu Guangtai) 徐光台 "Ruxue yu kexue: yige kexueshi guandian de tantao" 儒學與科學：一個科學史觀點的探討(Literati learning and science: from the

Before the arrival of the Jesuits, however, natural studies" in China had at times since the Yuan dynasty (1280-1368)) already been classified under the phrase *gezhi* 格致 At other times, particularly in the medieval period, such interests were expressed in terms of *bowu* 博物 (lit., "broad learning concerning the nature of things"). Among Song (960-1280) and post-Song literati elites, *gezhi* 格致 was the most common epistemological frame for the accumulation of knowledge *per se*. *Bowu* 博物 on the other hand carried with it a more common and popular notion of curiosities.[5] For example, the *Taiping yulan* 太平御覽 (Encyclopedia of the Taiping era, 976-83), compiled under imperial auspices by Li Fang 李昉 (925-96) during the early years of the Northern Song dynasty (960-1126), included earlier texts dealing exclusively with unusual events, strange objects, things, birds, spirits, and anomalies to provide a contemporary lexicon of textual usages in antiquity and medieval times that denoted the scope of *bowu* within classical writings.[6]

On the other hand, the Southern Song (1127-1279) philosopher Zhu Xi 朱熹 (1130-1200), who became the core interpreter of the late imperial classical canon, argued that "inquiring into and extending knowledge" presupposed that all things had their principle (萬物之理). Zhu therefore concluded: "one should in three or four cases out of ten seek principles in the outside realm" (三四分去外面理會方可). In most cases, six to seven out of ten, however, moral principles should be sought within. Thereafter, the investigation of

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viewpoint of the history of science), *Qinghua xuebao* 清華學報 (Taiwan), New Series, 26, 4 (December 1996): 369-92.

5 See Robert F. Campany, *Strange Writing: Anomaly Accounts in Early Medieval China* (Albany: SUNY Press, 1996), pp. 49-52.

6 *Taiping yulan* (Reprint of *Sipu congkan* 四部叢刊 edition. Taibei: Zhonghua Bookstore, 1960), 612.4a-10a.

things became the key to opening the door of knowledge for literati versed in the Classics and Histories.[7]

Due to Zhu Xi's later scholarly eminence, *gezhi* 格致 became a popular *Daoxue* 道學 ("Dao Learning," lit. "Learning of the Way") term, which was read into the Great Learning (*Daxue* 大學; one of the Four Books) in the *Record of Rites* (*Liji* 禮記; one of the Five Classics) by literati to discuss the form and content of knowledge.[8] Wang Yangming 王陽明 (1472-1528), on the other hand, preferred the original *Record of Rites* version o the Old Text version of the *Great Learning* to gainsay Zhu Xi's "externalist" views of the "investigation of things" in the Four Books. Subsequently, the delicate issue of the late Ming appearance of an even more ancient "stone inscribed version of the Great Learning" (*Daxue shiben* 大學石本), which was later determined a forgery, reopened for many sixteenth and seventeenth century literati Wang Yangming's famous claim that Zhu Xi had manipulated the original text of this key passage to validate and make canonical his personal interpretation of the "investigation of things." In particular, Wang Yangming gainsaid Zhu Xi's emphasis on *gewu* ahead of morality (*chengyi* 誠意, lit., "making one's intentions sincere"). For Wang the investigation of things and the extension of knowledge took a backseat to making one's will sincere.[9]

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7 See *Zhuzi yulei* 朱子語類(1473 edition. Taibei: Zhongcheng Bookstore reprint), 18.14b-15a. See also Yamada Keiji 山田慶兒, *Shushi no shizengaku* 朱子の自然學(Tokyo: Iwanami, 1978), pp. 413-72.

8 See Yü Ying-shih, "Some Preliminary Observations on the Rise of Qing Confucian Intellectualism," *Qinghua Journal of Chinese Studies*, New Series 11, 1 and 2 (December 1975): 125, for discussion of Wang Yangming's critique of Zhu Xi's elucidation of the *Great Learning*, which created a textual crisis in the sixteenth century.

9 See Wang Fan-shen, "The 'Daring Fool' Feng Fang (1500-1570) and His Ink Rubbing of the Stone-inscribed *Great Learning*," *Ming Studies* 35 (August 1995): 74-91. See also Wang Yangming, *Chuanxi lu* 傳習錄, in *Wang Yangming quanji* 王陽明全集 (Taibei: Kaozheng Press, 1973), #129.

During the late Yuan, *gezhi* as a *Daoxue* term was also used by the medical writer Zhu Zhenheng 朱震亨 (1282-1358) to denote technical learning. In Zhu's most famous work entitled *Gezhi yulun* 格致餘論 (Views on extending medical knowledge), which was included in the *Siku quanshu* 四庫全書 in the late eighteenth century,[10] Zhu opposed Song medical prescriptions, but he made a strong appeal to Yuan literati that they should include medical learning in their "Learning of the Way." In his view, medical learning was one of the key fields of study that not only complemented the moral and theoretical teachings of *Daoxue*, but it was also a key to the practical uses (*shixue* 實學) of the latter. The *Siku quanshu* editors cited Zhu's preface as arguing that medicine was one of the concrete fields that informed the "inquiry into and extension of knowledge" (格物致知之一事).[11]

In addition to its central epistemological place in literati classical learning since 1200, the notion of *gewu* was also applied to the collection, study, and classification of antiquities, as in Cao Zhao's 曹昭 (fl. 1387-99) *Gegu yaolun* 格古要論 ("Essential Criteria of Antiquities," lit., "Key issues in the investigation of antiquities"), which was published in the early Ming and enlarged several times thereafter. The work originally appeared in 1387/88 with important accounts of ceramics and lacquer, as well as traditional subjects such as calligraphy, painting, zithers, stones, bronzes, and ink-slabs. The 1462 edition prepared by Wang Zuo 王佐 (*jinshi* 進士 of 1427) was enlarged considerably and included findings from the official Ming dynasty naval expeditions led by Zheng He 鄭和 (1371-1433) to Southeast Asia and the Indian Ocean from 1405 to 1433. Wang also added the

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10 See Zhu Zhenheng, *Gezhi yulun*, in the *Siku quanshu* 四庫全書 edition (Reprint. Taibei: Commercial Press, 1983-86), Vol. 746-638.

11 See the "Tiyao"提要 of Zhu Zhenheng's study prepared by the editors of the *Siku quanshu zongmu* 四庫全書總目, compiled by Ji Yun 紀昀 et al. (Taibei: Yiwen Press reprint, 1974), 746-637.

subjects of imperial seals, iron tallies, official costumes, and palace architecture. In his "Preface," Wang added: "Whenever one sees an object, you must look it all over, trace its appearance, and examine its history and origins. You should investigate its strengths and weaknesses, and distinguish its accuracy" (凡見一物，必遍閱圖譜，究其來歷，格其優劣，別其是否而後已。). He was particularly interested in ancient bronzes, calligraphic specimens, and curiosities.[12]

Similarly, the Ming scholar and Hangzhou bookseller Hu Wenhuan 胡文煥 (fl. ca. 1596) compiled and published the *Gezhi congshu* 格致叢書(Collectanea of works inquiring into and extending knowledge) as a late Ming repository of classical, historical, institutional, and technical works from antiquity to the present in China that presented a cumulative account of all areas of textual knowledge important to a literati audience in the seventeenth century. No two editions of this collectanea were the same, and Hu printed several hundred works for this and other collectanea in his print shops in Nanjing and Hangzhou. By some accounts, the *Gezhi congshu* was divided into some thirty-seven categories (*lei* 類), such as classical instruction, philology, phonology, historical studies, rituals and regulations, legal precedents, geography, mountains and streams, medicine, Taoism, Buddhism, agriculture, stars, physiognomy, poetry and literature, painting, and epigraphy, among others. Only 181 works were available to the compilers of the *Siku quanshu*, and the version of the *Gezhi congshu* that focused strictly on the "investigation of things" contained 46 works that

[12] See the abridged version of the *Gegu yaolun*, in Hu Wenhuan 胡文煥(fl. ca. 1596) comp., *Gezhi congshu* 格致叢書(Ming Wanli edition, 1573-1619; microfilm, Taibei, National Central Library, Rare Books Collection), Vol. 25. See Wang Zuo's "Xu" 序, pp. 1a-b. See also Sir David Percival, trans., *Chinese Connoisseurship, the Ko Ku Yao Lun: The Essential Criteria of Antiquity*) (London: Faber, 1971). The new information from other parts of Asia, however, did not challenge the existing frameworks of knowledge in Ming China, which differs from the wider impact of sixteenth century oceanic discoveries in early modern Europe. See Lach, *Asia in the Making of Europe. Volume II. A Century of Wonder, Book 3*, pp. 446-89.

stressed classical philology and etymology, beginning with the 爾雅(Progress toward correctness) dictionary annotated by Guo Pu 郭璞 (276-324) of the Jin dynasty.[13] Overall, the *Gezhi congshu* collectanea emphasized a broad learning of phenomena (*bowu* 博物), one of the thirty-seven categories, that encompassed natural and textual studies within a humanist and institutional agenda.[14]

The term "*gezhi*" was also chosen by Ming literati in the seventeenth century as one of the native categories of specialized learning (*xuewen* 學問), with the latter equivalent to late medieval European *scientia*. Early Jesuit translations of Aristotle's theory of the four elements (*Kongji gezhi* 空際格致 , lit., "investigation of space," 1633) and Agricola's *De Re Metallica* (*Kunyu gezhi* 崑崳格致 , lit., "investigation of the earth," 1640) into classical Chinese, for example, had used the term *gezhi* 格致 in light of the Latin *scientia* (= "organized or specialized knowedge," or *xuewen* 學問, as *scientia* was translated in Chinese in the sixteenth century) in their titles.[15] "Dao Learning" doctrine and natural studies, particularly medical and calendrical learning, were not mutually exclusive.[16]

[13] See Hu, *Gezhi congshu* (Taibei, National Central Library edition from the Wanli period), which contains 46 works.

[14] Ibid., and Campany, *Strange Writing: Anomaly Accounts in Early Medieval China*, pp. 51-52. A preface for the version of 156 works in the Library of Congress edition of the *Gezhi congshu* is entitled *Baijia mingshu xu* 百家名書序 (Preface to the Renowned works of the Hundred schools).

[15] See Pan Jixing, "The Spread of Georgius Agricola's *De Re Metallica* in Late Ming China," *T'oung Pao*, 57 (1991): 108-18, and James Reardon-Anderson, *The Study of Change: Chemistry in China, 1840-1949* (Cambridge: Cambridge University Press, 1991), pp. 30-36, 82-88.

[16] See Roger Hart, "Local Knowledges, Local Contexts: Mathematics in Yuan and Ming China," paper presented at the Song-Yuan-Ming Transitions Conference (Lake Arrowhead, CA, June 5-11, 1997).

Willard Peterson in his valuable study of Fang Yizhi 方以智(1611-71) has noted how late Ming views of the *Daoxue* doctrine of the "investigation of things" (*gewu* 格物 , lit., "approaches to phenomena") had changed from a type of moral endeavor, purely, to an additional stress on external things. Fang Yizhi's magnum opus entitled *Wuli xiaozhi* 物理小識(Notes on the principles of things) stressed material investigations to comprehend the seminal forces underlying patterns of natural change. Fang generally accepted Western explanations of natural phenomena, such as a spherical earth, limited heliocentrism, and human physiology, brought by the Jesuits, but he was critical of them for leaving behind material investigations and ending in unverified religious positions. Fang Yizhi favored, instead, descriptive knowledge of the natural world, and he inscribed the "Dao Learning" interpretation of the "investigation of things" with a new view of the accumulation of knowledge, which gainsaid both the introspective focus of Wang Yangming and the moralist focus of Zhu Xi.[17]

Typically, interests in "natural studies" were restricted to fields relevant to bureaucratic governance and discussed in the basic Classics, or at least read into them by the early commentaries. It was important that astronomy, the calendar, and mathematics were discussed in the early Classics, for example, while medicine and alchemy were not. The "five phases," yin-yang, and "inauspicious calamities" were cosmological interpretations of the workings of nature within which political governance was rationalized according to the imperial synthesis of classical learning. Calendar reform remained an enduring cottage industry within the precincts of the Bureau of Astronomy and Astrology, but especially from

[17] Peterson, "Fang I-chih: Western Learning and the 'Investigation of Things,'" in Wm. Theodore de Bary et al., *The Unfolding of Neo-Confucianism* (N.Y.: Columbia University Press, 1975), pp. 369-411.

the late Ming to early Qing, roughly 1550 to 1700, when errors had accrued in the Ming official annual calendar.

Faced with the Jesuit challenge in natural studies, evidential scholars--who usually were the same literati we enumerate as important contributors to the history of science in pre-modern China--successfully blunted that challenge by contending that what then passed for "Western learning" was originally taught by the Chinese sage-kings in antiquity and had been passed on to the West, a doctrine known as "the origins of Western learning in China" (*Xixue Zhongyuan* 西學中源). In this way, Qing evidential scholars could call for a "return to antiquity" (*fugu* 復古) as a means to rehabilitate the ancient sciences and the mathematical classics that Western learning was derived from. Reconstructing the Song-Yuan mathematical techniques for solving simultaneous equations that resembled Jesuit algebra was a high priority, for example, in the late eighteenth century.

Such interest had built upon the early and mid-Qing findings of Mei Wending 梅文鼎 (1633-1721), who was sponsored by the Manchu court once his expertise in mathematical calculation (*lisuan* 曆算) and calendrical studies was recognized. Mei had contended that study of physical nature gave scholars access to the principles (*li* 理) undergirding reality. In essence, Mei saw Jesuit learning as a way to boost the numerical aspects of the *Daoxue* notion of moral and metaphysical principle.[18] At the same time, however, the imperial court and Mei Wending prepared preliminary accounts stressing the native Chinese origins (*Zhongyuan* 中源) of Western natural studies. Mei sought to restore and rehabilitate the native traditions in the mathematical sciences to their former glory. Under the Kangxi

[18] See John Henderson, "The Assimilation of the Exact Sciences into the Qing Confucian Tradition," *Journal of Asian Affairs* 5, 1 (Spring 1980): 15-31.

emperor's imperial patronage mathematical studies were upgraded from an insignificant skill to an important domain of knowledge for literati that complemented classical studies.[19]

Animated by a concern to restore native traditions in the precise sciences to their proper place of eminence, evidential scholars such as Dai Zhen (1723-77), Qian Daxin (1728-1804), and Ruan Yuan (1764-1849) successfully incorporated technical aspects of Western astronomy and mathematics into the literati framework for classical learning. Qian Daxin, in particular, acknowledged this broadening of the literati tradition, which he saw as the reversal of centuries of focus on moral and philosophic problems dictated by Cheng-Zhu "Learning of the Way": "In ancient times, no one could be a literatus (*ru* 儒) who did not know mathematics. Chinese methods [now] lag behind Europe's because *ru* do not know mathematics." Qian of course implied that evidential scholars like him had overcome that deficiency.[20]

Overall, Ruan Yuan's compilation of the *Chouren zhuan* 疇人傳 (Biographies of astronomers and mathematicians) while serving as governor of Zhejiang province in Hangzhou from 1797 to 1799, reprinted in 1849 and later enlarged, marked the climax of the celebration of natural studies within the Yangzi delta literati world of the eighteenth century. Containing biographies and summaries of the works of 280 *chouren*, including thirty-seven Europeans, this work was followed by four supplements in the nineteenth

[19] See Limin Bai, "Mathematical Study and Intellectual Transition in the Early and Mid-Qing," *Late Imperial China* 16, 2 (December 1995): 23-61, and Catherine Jami, "Learning Mathematical Sciences During the Early and Mid-Qing," in Elman and Woodside, eds., *Education and Society in Late Imperial China, 1600-1900* (Berkeley: University of California Press, 1994), pp. 223-56. On the Chinese origins theory, see Quan Hansheng 全漢昇, "Qingmo de 'xixue yuan chu Zhongguo' shuo"清末的西學源出中國說 , *Lingnan xuebao* 嶺南學報 4, 2 (June 1935): 57-102.

[20] *Qianyantang wenji* 潛研堂文集 (Collected essays from the Hall of Subtle Research) (8 vols. Taipei: Commercial Press, *Guoxue jiben ccngshu* edition, 1968), 3/335.

century. Limin Bai has noted how the mathematical sciences had begun to grow in importance among literati beyond the reach of the imperial court in the late eighteenth century. They were now linked to classical studies via evidential research. Because Ruan Yuan was a well-placed literati patron of natural studies in the provincial and court bureaucracy, his influential *Chouren zhuan* represented the integration of the mathematical sciences with evidential studies.[21] The period from 1780 to 1840 was a propitious time in foreign relations for Qing China, while Europe busied itself coping with the excesses of the French Revolution and the subsequent Napoleonic Wars that lasted to 1815. The Marcartney Mission of 1793 came and went in China uneventfully.

2. The Protestants and Modern Science in China

After the industrial revolution in Europe, and in the aftermath of the bloody defeat of the Taipings (1850-64), a weakened Qing dynasty and its literati-officials began to face up to the new scientific requirements to survive in a world increasingly filled with menacing industrializing nations. Literati such as Xu Shou 徐壽 (1818-82) and Li Shanlan 李善蘭 (1810-82), who were involved in translating the Western natural sciences into Chinese at the Jiangnan Arsenal in Shanghai beginning in the 1860s, built conceptual bridges between post-industrial revolution Western learning and the traditional Chinese sciences in the middle of the nineteenth century. Xu Shou, for example, used the *Bowu xinbian* 博物新編 (New edition of the broad learning of things) by Benjamin Hobson (1816-73), which was published in Canton in 1854, to construct China's first steamboat. A pioneering translation,

[21] Arthur Hummel, ed., *Eminent Chinese of the Qing Period*, p. 402. See also Limin Bai, "Mathematical Study and Intellectual Transition in the Early and Mid-Qing," pp. 23-30.

the *Bowu xinbian* contained introductory sections on modern physics, chemistry, astronomy, geography, and zoology.[22]

A new, nineteenth century version of "*Xixue*" now often equalled a new, nineteenth century version of "*gezhixue*." One of the volumes that paralleled the translation project for a Science Outline Series at the Jiangnan Arsenal in Shanghai, for example, focused on British scientific knowledge compiled by Henry Roscoe (1833-1915) and others, which was entitled *Gezhi qimeng* 格致啓蒙 (Primer on science studies).[23] In the process, post-industrial revolution Western science, now called modern science, was initially introduced in the mid-nineteenth century as compatible with but no longer subordinate to native classical learning.

Both Feng Guifen 馮桂芬(1809-74) and Xue Fucheng 薛福成 (1838-94) became administrative experts and advisors to the chief ministers of the late Qing, including Zeng Guofan 曾國藩 (1811-72) and Li Hongzhang 李鴻章 (1823-1901), the leaders of the post-Taiping turn toward foreign studies (*yangwu yundong* 洋務運動). Li Hongzhang, for example, followed Feng Guifen's recommendation and in 1863 established the Tongwen'guan 同文館 school of Western languages and science in Shanghai, which was added to the Jiangnan Arsenal in 1869. Li also proposed establishing eight categories for civil examinations (*bake qushi* 八科取士) in 1867, which included mathematics and science (*suanshu gezhi* 算數格致) and technology and manufacturing (*jiqi zhizuo* 機器制作) as a

22 Xiong Yuezhi 熊月之, *Xixue dongjian yu wan Qing shehui* 西學東漸與晚清社會 (The eastern dissemination of Western learning and late Qing society) (Shanghai: Renmin chubanshe, 1994), and Wang Yangzong 王揚宗, "Liuhe congtan zhong de jindai kexue zhishi ji qi zai Qingmo de yingxiang" 六合叢談中的近代科學知識及其在清末的影響 (Knowledge of modern science in the *Shanghae Serial* and its impact in the late Qing), *Zhongguo keji shiliao* 中國科技史料 20 (1999.3): 212-14.

23 See *Gezhi qimeng*, translated by Young J. Allen et al. (Shanghai: Jiangnan Arsenal Publication, 1875).

single category.[24] Many Qing literati and officials became obsessed with the goal of wealth and power (*fuchiang* 富強), which in the last decades of the dynasty became the technical term for political economy, as in Joesph Edkin's (1823-1905) translation entitled *Fuguo yangmin ce* 富國養民策 (Policies for enriching the dynasty and nourishing the people), which was included as a volume in an 1886 series translated by Edkins and also entitled *Gezhi qimeng*, which was published by the Commercial Trade Office under the Foreign Affairs Bureau.

Literati associated with evidential studies after the Taiping Rebellion created the intellectual space needed to legitimate literati study of natural studies and mathematics. For instance, Li Shanlan first went to Shanghai in 1852 and for eight years there worked for the London Missionary Society to translate Western science works into classical Chinese. Later, Li was recommended to the newly established Beijing Tongwen'guan translators' bureau in 1864, but he took up the appointment in 1866 only after the Tongwen'guan was upgraded to a college and a department of mathematics and astronomy was added. There, Li Shanlan worked with W. A. P. Martin (1827-1916), who served as president of the college from 1869 to 1882, to teach mathematics and prepare scientific translations.[25]

Xu Shou initially collaborated with John Fryer (1839-1928) at the Jiangnan Arsenal in Shanghai to translate Western scientific literature into classical Chinese, an enterprise that combined a narrow, textually based vision of science, brought by Protestant missionaries to attract Chinese converts, with the Chinese view of the sciences as a domain of classical

24 See "Yangwu yundong dashiji" 洋務運動大事記, in Xu Tailai 徐泰來, ed., *Yangwu yundong xinlun* 洋務運動新論(Changsha: Hunan People's Press, 1986), pp. 349-448, and *Eminent Chinese*, pp. 240-43, 331-33.

25 See *Eminent Chinese of the Qing Period*, p. 480.

studies appropriate only for literati. Together they founded the *Gezhi shuyuan* 格致書院 in Shanghai in 1874, which was curiously translated into English as the "Shanghai Polytechnic Institute." From different sides, Chinese literati and Western modernizers saw in *gezhi* what they wanted to see, a native trope or Western science.

The Institute had a reading room and library of scientific works. Xu and Fryer also created the first science journal in China entitled *Gezhi huibian* 格致彙編, known in English as "The Chinese Scientific Magazine," which ran first monthly issues from 1876 to 1882 in Shanghai and then quarterly from 1890 to 1892. At its peak it reached some 2000 readers in the treaty ports. Such conceptual compromises were based on maintaining the post-Jesuit term for natural studies, i.e., *gezhi*, but this time using *gezhi* to refer to modern Western, not pre-modern, science. In this way, mathematics and the other more industrial sciences such as chemistry became acceptable, if still less popular than the civil service, activities for literati.[26]

The Song-Yuan "heavenly element notation" (*tianyuanshu*) and "four elements notation" (*siyuanshu*) forms for expressing and solving quadratic and higher algebraic equations of several unknowns, once recovered in the late eighteenth century by Mei Juecheng 梅瑴成 (d. 1763)--Mei Wending's grandson--and others, were thought by Qing evidential scholars to be superior to the algebraic techniques introduced to China by the Jesuits. Not until the introduction of the differential and integral calculus in the mid-nineteenth century, for which the Chinese could not find a precedent in China, did Li

[26] David Reynolds "Re-Drawing China's Intellectual Map: 19th Century Chinese Images of Science," *Late Imperial China* 12, 1 (June 1991): 27-61. See also David Wright, "John Fryer and the Shanghai Polytechnic: making space for science in nineteenth-century China," *British Journal of the History of Science* 29 (1996): 1-16, and Wright, "Careers in Western Science in Nineteenth-Century China: Xu Shou and Xu Jianyin," *Journal of the Royal Asiatic Society*, third series, 5 (1995): 49-90. Cf. James Reardon-Anderson, *The Study of Change*, pp. 17-28, 45-48.

Shanlan and other Chinese mathematicians finally admit that although the "four elements notation" was perhaps superior to Jesuit algebra, the Chinese had never developed anything resembling the calculus.

Similarly, the "Chinese origins" trope in Chinese mathematics was what Alexander Wylie's (1815-87) and Li Shanlan's influential 1857 article entitled "Xiguo tianxue yuanliu" 西國天學源流(Progress of astronomical discovery in the West) aimed at refuting. The article appeared serially from the ninth issue (September 1857) of *Liuhe congkan* 六合叢刊 (Shanghai Miscellany) in a total of seven issues and was reissued as a single work in 1890. Wylie and Li Shanlan traced the history of western astronomy from the ancient Greeks to Ptolemy, then to Copernicus, Kepler, Galileo, and Newton up to the eighteenth and early nineteenth century, thereby demonstrating that it had evolved separately from China.[27]

Despite such promising developments, however, they took place in an East Asian political context in which Meiji Japan was rapidly outpacing Qing China in science and technology.

3. The Denigration of Traditional Chinese Natural Studies

Despite the relative success of traditional Chinese natural studies and Western science in developing together among literati elites in China from the seventeenth to the late nineteenth century under the rubric of *gezhixue*, there was little attention until 1850 by those same elites to European science as a form of practice requiring laboratories to replicate experiments and for such experiments to confirm or reject past scientific findings. For Catholic or Protestant missionaries and literati mathematicians, natural studies was little

[27] Wang Yangzong , "Liuhe congtan zhong de jindai kexue zhishi ji qi zai Qingmo de yingxiang," pp. 211-26.

more than a textual exercise requiring translation of technical knowledge, mastery of those technical texts, and the reproduction via memory of technical learning.

Moreover, after the Taiping Rebellion those who were drawn to scholarly work in the new industrial arsenals in Fuzhou, Shanghai, and elsewhere, or translation positions in the three Tongwen'guan in Beijing, Shanghai, and Guangdong, tended to be relatively marginal literati such as Xu Shou and Li Shanlan, men who had failed the more prestigious civil examinations several times and saw Western learning and the sciences as an alternative, but still secondary, route to fame and fortune. Yan Fu 嚴復(1853-1921) and Lu Xun 魯迅 (1881-1936) were also famous examples of this alienated group of outcasts from the civil examinations that initially served as the pool of highly educated men who filled the more limiting world of late Qing institutions oriented toward *gezhixue*.[28]

Recent research indicates, however, that the various arsenals, shipyards, and factories in the treaty ports were important technological venues for experimental practice where, in addition to the production of weapons, ammunition, and navies, a union of scientific knowledge and experimental practice among literati and artisans was first forged in Shanghai, Nanjing, Tianjin, Wuhan, and elsewhere. The Jiangnan Arsenal in Shanghai and the Fuzhou Shipyard, for instance, were generally acknowledged by Europeans and Japanese to be more advanced than their competitor in Meiji Japan, the Yokosuka Dockyard, until the 1880s. Accordingly, outside the civil examination regime, where millions competed for few places in the bureaucracy, a notable group of doctors, nurses and medical assistants were trained in missionary schools, and an even larger group of engineers,

[28] David Wright, "The Great Desideratum: Chinese Chemical Nomenclature and the Transmission of Western Chemical Concepts," *Chinese Science* 14 (1997): 35-70.

military technicians, and technical specialists were instructed in the arsenals and shipyards.[29]

It was not until the Sino-Japanese War, when the Japanese navy, which was tied to Yokosuka technology, decisively defeated the Qing navy, which was tied to Fuzhou and Shanghai technology, that the alleged superiority of Japan in military technology, or so it was interpreted, became common knowledge to Chinese and Japanese patriots. Although the Jiangnan Arsenal had appeared superior in science and technology to Yokosuka until the 1880s, after 1895 each side then read their different fates in 1895 teleologically back to the early Meiji period (later even back further to *Rangaku* 蘭學"Dutch Learning" in Tokugawa Japan), in the case of triumphant Japan, or back to the failures of the self-strengthening movement after 1865 (later back to all classical learning), in the case of the defeated Qing.

Another sea change in elite and popular opinion in late Qing China now determined how the Manchu-Chinese refraction of Western science and technology through the lens of *gezhixue* would be interpreted after 1895. Literati radicals such as Yan Fu declared that accommodation between Chinese ways and Western institutions had failed. The Sino-Japanese War thus altered the frame of reference for the 1860-95 period for both Chinese and Japanese. The beginnings of the "failure narrative" for Chinese science, i.e., why China had not produced science, paralleled the story of political decline (why no democracy) and economic deterioration (why no capitalism) during the late empire.[30]

[29] See Meng Yue, "Hybrid Science *versus* Modernity: The Practice of the Jiangnan Arsenal," *East Asian Science* 16 (1999): 13-52. See also Takehiko Hashimoto, "Introducing a French Technological System: The Origin and Early History of the Yokosuka Dockyard," *East Asian Science* 16 (1999): 53-72, and David Wright, "Careers in Western Science in Nineteenth-Century China, p. 81.

[30] Reardon-Anderson, *The Study of Change: Chemistry in China*, pp. 76-78.

Yan Fu, whose poor prospects in the civil examinations led him to enter the School of Navigation of the Fuzhou Shipyard in 1866, associated the power of the West with modern schools where students were trained in modern subjects requiring practical training in the sciences and technology.[31] For Yan Fu and the reformers, Western schools and Westernized Japanese education were examples that the Qing dynasty should emulate. The extension of mass schooling within a standardized classroom system stressing science courses and homogeneous or equalized groupings of students seemed to promise a way out of the quagmire of the imperial education and civil examination regime, whose educational efficiency was now, in the 1890s, suspect.[32]

One of the products of the iconoclasm of the 1898 reforms that survived the Empress Dowager's coup that year was the Imperial University of Beijing, which was established to be at the pinnacle of an empire-wide network of schools that would expand on the Tongwen'guan. The new university was designed like the Translation College to train civil degree-holders, i.e., literati, in Western subjects suitable for government service. W.A.P. Martin, who had earlier worked with Li Shanlan, was chosen as the dean of the Western faculty. Science courses at the Imperial University, interestingly, were still referred to as *gezhi*, and the facilities included modern laboratories equipped with the latest instruments for physics, geometry, and chemistry. This promising development was short-lived, however, because rebels associated with what was called the Boxer Rebellion smashed everything in sight at the university in the summer of 1900. European armies had not been any kinder to

[31] Marianne Bastid, *Educational Reform in Early 20th-Century China*, translated by Paul J. Bailey (Ann Arbor: University of Michigan China Center, 1988), pp. 12-13, and Y. C. Wang, *Chinese Intellectuals and the West, 1872-1949* (Chapel Hill: University of North Carolina Press, 1966), pp. 52-59.

[32] See Elman, *A Cultural History*, pp. 585-94.

things Chinese during their occupation of Beijing after the Boxer siege of the foreign legations was lifted.[33]

The race to establish new institutions of higher learning that would stress modern science accelerated after the occupation of the capital by Western and Japanese troops in 1900. The Boxer popular rebellion and the response of the Western powers and Japan to it unbalanced the power structure in the capital so much that foreigners were able to put considerable pressure on provincial and metropolitan leaders such as Li Hongzhang. Foreign support of reform and Western education thus strengthened the political fortunes of provincial reformers such as Yuan Shikai 袁世凱 (1859-1916) and Zhang Zhidong 張之洞 (1837-1909), who had opposed the Boxers.[34]

The delegitimation of classical learning after 1900 initially did not challenge the use of *gezhi* as a term from the Four Books to translate modern science into classical Chinese, however. In the reformed, post-1901 civil examinations, for example, candidates were asked to assess the importance of modern science. A catalog of policy questions used in the examinations after the reforms, which was compiled in 1903, identified the "sciences" (格致) as two of the thirty-two categories that were used. For example, five of the eight questions on the natural sciences, which was still called *gezhi* in Chinese, were phrased as follows:

[33] See Renville Lund, "The Imperial University of Beijing" (University of Washington Ph.D. dissertation, 1956), pp. 118-22, and Reardon-Anderson, *The Study of Change: Chemistry in China*, p. 109.

[34] Elman, *A Cultural History*, pp. 608-18. See also Paul Bailey, *Reform the People: Changing Attitudes Towards Popular Education in Early Twentieth Century China* (Edinburgh: Edinburgh University Press, 1990), pp. 26-27, who stresses the Boxer Rebellion as the "turning point in the court's attitude towards reform."

1. Much of European science originates from China (中國); we need to stress what became a lost learning as the basis for wealth and power.
2. In the sciences, China and the West (泰西) are different; use Chinese learning (中學) to critique Western learning (西學).
3. Substantiate in detail the theory that Western methods all originate from China.
6. Prove in detail that Western science studies mainly were based on the theories of China's pre-Han masters.
7. Itemize and demonstrate using scholia that theories from the Mohist Canon preceded Western theories of calendrical studies, light, and pressure.[35]

Such views revealed that in official terms, the wedding between the traditional Chinese sciences and Western science, worked out beginning in the eighteenth century, was still in effect. Publicly at least, the officials of the late Qing dynasty maintained the fiction that "the Western sciences for the most part derived from the teachings of the pre-Han masters" (西人格致之學多本於中國諸子之說).[36]

After 1905, however, when the civil examinations had been abolished, the ever increasing number of overseas Chinese students in Japan, Europe, and the United States perceived that outside of China the proper language for science included a new set of concepts and terms that superseded traditionalist literati notions of natural studies associated with *gezhi*. For example, Japanese scholars during the early Meiji period had already in the 1860s demarcated the new sciences by referring to *wissenschaft* as *kagaku*

[35] See *Zhongwai shiwu cewen leibian dacheng* 中外時務策問類編 (Great compendium of policy questions on Chinese and foreign affairs classified topically) (1903 edition), *mulu* 目錄, pp. 1a-28b, especially 13a-13b.

[36] Ibid., "*mu-lu*," p. 13a.

(*kexue* 科學; lit., "classified learning based on technical training")[37] and natural studies as *kyûri* (*qiongli* 窮理, lit. "exhaustively study the principles of things"). The latter term, long associated with "Dao Learning" in China since the Song dynasty, was reinterpreted in Japan based on the Dutch Learning tradition of the late eighteenth century, when Japanese scholars interested in Western science still used terms from Chinese learning (*Kangaku* 漢學) to assimilate European natural studies and medicine.[38]

Chinese students and scholars initially adopted the Japanese bifurcation between technical learning and natural studies. Yan Fu, for instance, rendered the terms science or sciences as *kexue* in his 1900-02 translation of John Stuart Mill's *System of Logic*, while translating natural philosophy as *gewu* 格物, or the "investigation of things." Similarly, when regulations for modern schools were promulgated in 1903, the term *gezhi* was used to refer collectively to the sciences in general, while the sciences as individual, technical disciplines were designated as *kexue*. This two-track terminology for science lasted through the end of the Qing dynasty and was continued during the early years of the Republic of China, but Chinese students who returned from abroad increasingly saw the need to develop a single Chinese term for the Western sciences that would leave behind the earlier assimilation of traditional Chinese natural studies into modern science.[39]

[37] Lydia Liu, *Translingual Practice*, pp. 33, 336, presents *kexue/kagaku* as a second-hand *kanji* borrowing from classical Chinese that the Japanese used to translate science into Japanese. Her source is the Song dynasty literatus Chen Liang 陳亮(1143-94), where Chen uses *kexue* as a shorthand reference to mean civil examination studies (*keju zhi xue* 科舉之學 equals *kexue*). This twelfth-century usage is unique to the Song dynasty, which the Japanese borrowed.

[38] Albert Craig, "Science and Confucianism in Tokugawa Japan," in Marius Jansen, ed., *Changing Japanese Attitudes Toward Modernization* (Princeton: Princeton University Press, 1965), pp. 139-42.

[39] Reardon-Anderson, *The Study of Change: Chemistry in China*, pp. 82-87.

Many overseas students were as radical in their political and cultural views, which carried over to their scientific iconoclasm. Traditional natural studies became part of the "failed" history of traditional China to become "modern," and this view now included the claim that the Chinese had never had any science. The earlier claim for the "Chinese origins" of Western science, so prominent before 1900, was now deemed superstition (迷信). What had come before modern *kexue* was magic and the supernatural, not science. How pre-modern Chinese demarcated the natural and supernatural was lost, when both "modernists" and "socialists" in China accepted the West as source of all science as *kexue*, which was diametrically opposed to *gezhi*.

Linkage between political revolution and the perception by many radicals that a scientific revolution was also required influenced the changes that occurred after 1911. Those Chinese who thought a revolution in knowledge based on Western learning was required not only challenged what they called "Confucianism" (*Kongjiao* 孔教), but they also unstitched the interwoven patterns of traditional Chinese science, medicine, and classical learning long accepted as components of an ideological tapestry buttressing imperial orthodoxy.[40] Those educated abroad at Western universities such as Cornell University or sponsored by the Rockefeller Foundation after 1914 for medical study in the United States, as well as those trained locally at higher-level missionary schools, regarded modern science as *kexue* 科學, not *gezhixue*, because they believed the latter term was derived from the language of the discredited past and inappropriate for modern science.

The belief that Western science represented a revolutionary application of scientific methods and objective learning to all modern problems was increasingly articulated in the

[40] See Elman, "The Formation of "'Dao Learning'" as Imperial Ideology During the Early Ming Dynasty," in T. Huters, R. Bin Wong, and P. Yu, eds., *Culture and the State in Chinese History*, (Stanford: Stanford University Press, 1997), pp. 58-82.

journals associated with the New Culture Movement. The journal *Kexue* 科學 (Science), which was published by the newly founded (in 1914) Science Society of China (*Zhongguo kexueshe* 中國科學社) and first issued in 1915, assumed that an educational system based on *kexue* was the panacea for all of China's ills because its knowledge system was superior. By 1920, the Science Society, which had been founded by overseas Chinese students at Cornell in 1914, had some 500 members in China and grew to 1000 in 1930.[41]

Such uncritical faith in science, i.e., "scientism" (*kexue zhuyi* 科學主義), on the part of Chinese scientists trained abroad, many from Cornell, was iconoclastic in its implications for traditional natural studies in China and influenced post-imperial literati such as Chen Duxiu 陳獨秀 (1879-1942), who argued in the issues of the journal *Xin'qingnian* 新青年 (New youth), which he helped found in 1915, that science and democracy were the twin pillars of a modern China that must dethrone the imperial past. In the process, post-imperial scholars and novelists such as Ba Jin 巴金 (Li Feigan 李芾甘; b. 1904) in his1931 novel *Family* 家, for example, initiated an assault on pre-modern Daoism and medicine as a haven of superstition and backwardness.

During the early Republic, the elite view of popular customs (*fengsu* 風俗) was also reconfigured in modernist terms, a trend that included Xu Ke's 徐珂 *Qingbai leichao* 清稗類鈔 (Classified jottings on Qing dynasty unofficial history). In Xu's collection, popular lore was divided up and reclassified into the categories of "magicians and shamans" (*fangji* 方伎) and "confused beliefs" (*mixin* 迷信), for example. Xu Ke intended his collection of lore, published in 1917, as a sequel to the Northern Song dynasty *Taiping kuangji* 太平廣記

[41] See Peter Buck, *American Science & Modern China* (Cambridge Univ. Press, 1980), pp. 171-85, and D. W.. Y. Kwok, *Scientism in Chinese Thought, 1900-1950* (New Haven: Yale University Press, 1965), *passim*.

(Expanded records of the Taiping reign, 976-83) and the later *Songbai leichao* 宋稗類鈔 (Classified jottings on Song dynasty unofficial history). However, the new cultural context ensured that such lore was publicly acceptable among modernist literati only if it could be pigeonholed as superstition.[42]

Traditional Chinese medicine, which was the strongest field of the Chinese sciences during the transition from the late Qing to the Republican era, was also subjected to such derision, although it was more successful in retaining its prestige than Chinese astrology, geomancy, and alchemy, which were dismissed by modern scholars as purely superstitious forms of knowledge.[43] When the Guomindang-sponsored Health Commission proposed to abolish Chinese medicine (*Zhongyi* 中醫) in February 1929, for example, traditional Chinese doctors responded by calling for a national convention in Shanghai on March 17, 1929, which was supported by a strike of pharmacies and surgeries nationwide. The protest succeeded in having the proposed abolition withdrawn, and the Institute for National Medicine (*Guoyiguan* 國醫館) was subsequently established. One objective, however, was to reform Chinese medicine along Western lines.[44]

In the aftermath of the 1894-95 Sino-Japanese War, Chinese reformers, radicals, and revolutionaries turned to Japanese and Western science as an intellectual weapon to destroy the perceived backwardness of "Chinese science."[45] After 1900, the teleology of a universal

[42] *Qingbai leichao* (Shanghai: Commercial Press, 1920), 74.11, and *passim*.

[43] Eugenia Lean, "The Modern Elixer: Medicine as a Consumer Item in the Early Twentieth-Century Press," M.A. degree paper, November 1996.

[44] See Bridie Andrews, "Tuberculosis and the Assimilation of Germ Theory in China, 1895-1937," *Journal of the History of Medicine and Allied Sciences* 52, 1 (1997): 142-43.

[45] Reardon-Anderson, *The Study of Change: Chemistry in China*, pp. 76-78. See also Nathan Sivin, "Max Weber, Joseph Needham, Benjamin Nelson: The Question of Chinese Science," in E. Victor Walter, ed., *Civilizations East and West: A Memorial Volume for Benjamin Nelson* (Atlantic Highlands, N.J.: Humanities Press, 1985).

and progressive "science" first invented in Europe replaced the Chinese notion that Western natural studies had their origins in ancient China. The dismantling of the traditions of *gezhixue* and *bowuxue*, among many other categories, that had linked natural studies, natural history, and medicine to classical learning from 1370 to 1905 climaxed during the cultural and intellectual changes of the New Culture Movement. When their iconoclasm against classical learning and its traditions of natural studies climaxed after 1915, New Culture advocates helped replace the imperial tradition of natural studies with modern science and medicine.[46]

Culturally, the longstanding affinity between literati learning and natural studies was also severed between 1905 and 1915. As elites turned to Western studies and modern science, fewer remained to continue the traditions of classical learning (Han Learning) or Cheng-Zhu moral philosophy (Song Learning) that had been the basis for imperial orthodoxy and literati statuses before 1900. Thereafter, the "traditional Chinese sciences," classical studies, "Confucianism," and "Neo-Confucianism" survived as vestigial learning in the public schools established by the Ministry of Education after 1905 and have endured as contested scholarly fields taught in the vernacular in universities since 1911. The millennial hierarchy of literati learning, based on the Four Books and Five Classics, study of the Dynastic Histories, mastery of poetry, and traditional natural studies was demolished in favor of modern science and its impact via Darwinism on social and historical studies.[47]

What then ensued after 1911 was a remarkable intellectual consensus among Chinese and Western scholars that imperial China had failed to develop science before the Western

[46] See Min-chih Maynard Chou, "Science and Value in May Fourth China: The Case of Hu Shih" (University of Michigan Ph.D. dissertation in History, 1974), pp. 23-35.

[47] See James R. Pusey, *China and Charles Darwin* (Cambridge: Harvard University Press, 1983), *passim*.

impact. Even the Chinese protagonists involved in the 1923 "Debate on Science and Philosophy of Life," which we will discuss below, accepted the West as the repository of scientific knowledge and merely sought to complement such knowledge with moral and philosophical purpose.[48] The consensus then drew on heroic accounts of the rise of Western science to demonstrate that imperial China had no science worthy of the name. Both Western scholars and Westernized Chinese scholars and scientists had so essentialized European natural studies into a universalist ideal that when Chinese studies of the natural world, her rich medieval traditions of alchemy, or pre-Jesuit mathematical and astronomical achievements in China were discussed, they were usually treated dismissively and tagged with such epithets as "superstitious," "prescientific," or "irrational" to contrast them with the triumphant objectivity and rationality of the modern sciences. Many scholars were so convinced that because China had had no industrial revolution and had never produced capitalism, therefore the Chinese could never have produced science.

4. The Legacy of the 1923 "Debate on Science and Philosophy of Life"

The "Great War," however, acted as a profound intellectual boundary between those in Republican China who still saw in modern science an ideal intellectual model for the future and the "New" Confucians, such as Zhang Junmai 張君勱 (1886-1969), who showed renewed sympathy for older forms of moral order after the devastation visited on Europe from 1914 to 1919. Liang Qichao 梁啓超(1873-1929), who was then in Europe leading an

[48] See See Wang Hui, "The Fate of 'Mr. Science' in China: The Concept of Science and Its Application in Modern Chinese Thought," *positions: east asia cultures critique* 3, 1 (spring 1995): 14-29. See also Charlotte Furth, *Ting Wen-chiang: Science & China's New Culture* (Cambridge: Harvard University Press, 1970).

unofficial group of Chinese observers at the 1919 Paris Peace Conference, traveled to a number of European capitals in 1919. Both Zhang Junmai and Ding Wenjiang 丁文江 (1887-1936), the future antagonists in the 1923 "Debate on Science and Philosophy of Life" were included in Liang's group. Each witnessed the war's deadly technological impact on Europe, but more importantly, perhaps, they met with leading European intellectuals such as the German philosopher Rudolf Christoph Eucken (1846-1926), Zhang Junmai's teacher, and the French philosopher Henri Bergson (1859-1941).[49]

In his *Ouyou xinyinglu jielu* 歐遊心影錄節錄 (Condensed record of travel impressions while in Europe), Liang Qichao related how the Europeans they met with regarded the first world war as a sign of the bankruptcy of the West and the end of the "dream of the omnipotence of modern science" (科學萬能之夢). Rather than getting advice about modernity from these Europeans, Liang found instead that they now sympathized with what they considered the more spiritual and peaceful "Eastern civilization" and bemoaned the legacy in Europe of an untrammeled material and scientific civilization that had fueled the world war. Liang's account of the spiritual decadence in post-war Europe was tied to an indictment of the materialism and the mechanistic assumptions undergirding modern science and technology. The lesson was clear. A turning point had been reached, and the dark shadow of "Mr. Science" (科學先生) had been exposed. Behind it lay the colossal ruins produced by Western materialism.[50]

[49] See Ding Wenjiang, *Liang Rengong xiansheng nianpu changbian chugao* 梁任公先生年譜長編初稿(First draft of a chronological biography of Liang Qichao) (2 vols. Taibei, Shijie shuju, 1972), pp. 551-74.

[50] For the *Ouyou xinyinglu jielu*, see Liang Qichao, *Yinbingshi zhuanji* 飲冰室專集(Collected works from the Ice-Drinker's Studio) (10 vols. Taibei: Zhonghua shuju, 1972), Vol. 7, pp. 10-12. For discussion, see Chow Tes-tsung, *The May 4th Movement: Intellectual Revolution in Modern China* (Cambridge: Harvard University Press, 1960), pp. 327-29, and Jerome

In 1919, however, Liang Qichao was still careful to criticize only the mythology surrounding science and not science itself. He added this note to the end of the section of his travel impressions on the "dream of the omnipotence of modern science": "Readers, please do not misunderstand this as an attack on science. I definitely do not acknowledge the bankruptcy of science. However, I do not acknowledge the omnipotence of science either." Whether pro science or not, it was clear from Liang's account that the West had produced it. To remedy its excesses, he appealed to the spiritual resources that traditional Chinese civilization could provide. Liang made no mention of the pre-modern scientific achievements of Chinese civilization in 1919 (he had in some earlier writings), because his measure of science and technology was modern science (now called "*kexue*") and not traditional natural studies (*gezhixue*).[51]

In the comparison between China and the West, China's pre-modern science was not worth taking seriously. Earlier in 1902, while Liang was living in exile in Japan, he had composed a three-part article surveying the history of science in the West, which he entitled "Gezhixue yange kaolue"格致學沿革考略(Synopsis of the vicissitudes in the history of science). In that 1902 account Liang noted that 200-300 years ago, except for "*gezhixue*" (i.e., "modern science"), China had been comparable to the West in all other fields of learning. Liang's article presented the scope of *gezhixue* in the West and its relation to other specialized fields since the ancient Babylonians and Greeks. He then discussed the Arab transmission of Greek science to Europeans.

Ironically, Liang added, printing, gunpowder, and the compass, which all came from China to Islam and then were transmitted to Europe, had enabled the scientific revolution

Grieder, *Hu Shih and the Chinese Renaissance: Liberalism in the Chinese Revolution, 1917-1937* (Cambridge: Harvard University Press, 1970), pp. 129-35.

[51] Liang, *Ouyou xinyinglu jielu*, Vol. 7, p. 12.

(*kexue gexin* 科學革新) in sixteenth century Europe but not in China. Although Liang used the term *gezhixue* for modern science, in addition to *kexue*, the former no longer evoked memories of the patient "investigation of things and the extension of knowledge" that earlier Chinese literati had inscribed in its semantic life as a translation for "science." Liang's intellectual transition from *gezhixue* in 1902 to *kexue* 1919 as the Chinese translation for modern science was not mentioned. Science now equaled "*kexue*" only.[52]

Liang Qichao's postwar disillusionment with Western civilization and its false dream of the omnipotence of science had wide impact in China among students and scholars when his travel impressions of Europe were syndicated in China in 1919 and again when published all together as a separate work. Subsequently in 1921 Liang Shuming 梁漱溟 (b. 1893) presented a series of lectures at Beijing University and elsewhere in 1920 and 1921 that addressed the subject of Eastern and Western civilizations, specifically comparing the West, China, and India. In the aftermath of the first world war, Liang Shuming's lectures reopened the "cultures controversy" that Liang Qichao's travel impressions had initiated. After it was published in late 1921, Shuming's book, entitled *The Cultures of East and West and Their Philosophies* (*Dongxi wenhua ji qi zhexue* 東西文化及其哲學) went through eight printings in four years, signaling that the native backlash against the excesses of the 1915 New Culture Movement and its faith in "Mr. Science" was gaining a wider audience among the emerging intelligentsia in China's urban centers.[53]

[52] Liang Qichao, "Gezhixue yange kaolue," in *Yinbingshi wenjii* 飲冰室文集 (Collected writings from the Ice-Drinker's Studio) (8 vols. Taibei: Zhonghua shuju, 1970), Vol. 2, pp. 3-14.

[53] See Guy Alitto, *The Last Confucian: Liang Shu-ming and the Chinese Dilemma of Modernity* (Berkeley: University of California Press, 1979), pp. 77-81.

Searching for a solution to the malaise China faced, Liang Shuming directly confronted the central premise of the New Culture Movement, namely that Chinese culture was doomed and should be replaced by a modern Western version of culture based on science. Unlike Liang Qichao, who saw the salvation of Chinese culture in an amalgamation of its spiritual strengths with the scientific strengths of Western civilization, Liang Shuming contended that Chinese culture must survive intact or not at all. A synthesis of East and West was impossible because of the cultural uniqueness that each civilization manifested.[54]

Evoking the legacy of the German romantics and their anti-materialist appeals to human voluntarism and vitalism, Liang Shuming was in many ways reiterating for Chinese what Eucken and Bergson were arguing in Europe in the aftermath of world war one. Oswald Spengler's (1880-1936) *Der Untergang des Abendlandes* (The decline of the West), for example, was first published in 1918, at the moment of Germany's bitter defeat, and became a bestseller in Europe. Its central premise was that all cultures had their peculiar configurations and therefore must be studied to understand their unique strengths and weaknesses. The cultural life of all nations and peoples followed cultural cycles that by necessity must run their course, as Western civilization now realized. The question for Spengler was what new culture might appear to replace Europe's. In his defense of Chinese civilization as the antidote to the excesses of Western materialism, Liang Shuming was making Chinese philosophy and the Chinese way of life the next destination for world culture--after leaving behind the dead-end of Western modernity.[55]

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[54] See Grieder, *Hu Shih and the Chinese Renaissance*, pp. 135-45.

[55] See Elman, "Wang Kuo-wei and Lu Hsun: The Early Years," *Monumenta Serica*, 34 (1979-80): 389-401, Alitto, *The Last Confucian*, pp. 82-125, and Grieder, *Hu Shih and the Chinese Renaissance*, pp. 137-44. Cf. Paul Edwards, ed., *The Encyclopedia of Philosophy* (8 vols. New York: Macmillan Publishing Co., Inc. and The Free Press, 1967), 1/287-95, 3/134-35, 7/527-30.

This approach struck a responsive cord among many Chinese intellectuals who thought that cultural iconoclasm in China under the Republic had gone too far. Traditional Chinese culture and values could now be salvaged intact because their anti-materialist spiritual foundations were the remedy for modern European excesses in the name of science and technology. The Beijing University philosophy professor Fung Yu-lan, for instance, while at Columbia University in 1922 published an article in English entitled "Why China Has No Science--An Interpretation of the History and Consequences of Chinese Philosophy." Rather than dwelling on China's failures, Fung argued instead that according to her own traditional standard of values China did not need science. Daoism had emphasized the return to nature against human artificiality. The pre-Han philosopher Mozi had stressed utilizing the past to control the future, which included a system of logic or definitions. Later Confucians, had debated whether knowledge of external things took priority (following Zhu Xi), or the internal stress on the mind (following Wang Yangming) was more important than mastering the world. Since Chinese did not regard life as a search for power, Fung continued, they stressed human and practical affairs and thus had no need of scientific certainty. The lesson Fung Yu-lan drew was that Wang Yangming had been wrong. Chinese must stop searching for the truth in the "barren land of the human mind."[56]

Similarly Hu Shi (1891-1962) in 1921 published an article praising the scholarly methodology of Qing dynasty textual scholars as a Chinese precedent for contemporary research. The English version of this essay was reworked in 1962 when it was published under the title "The Scientific Spirit and Method in Chinese Philosophy." The essay in Chinese was followed in 1922 by the publication of Hu's 1917 Columbia University

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[56] *International Journal of Ethics* 32, 3 (April 1922): 237-63.

dissertation entitled *The Development of the Logical Method in Ancient China* (Shanghai, Oriental Book Co.). As radical culturally as Hu Shi had been during the New Culture Movement--he was also one of the founders of the Science Society of China while at Cornell in 1914--Hu Shi was also moderating his views after the first world war. But in his own mind he was still a public advocate of the West and saw modern science as the universal model. When China conformed with that model, as with aspects of Qing evidential studies, Hu Shi praised China; when it didn't, then China had to change.[57]

The cultures controversy finally boiled over, however, when Zhang Junmai presented a lecture at Qinghua University on February 14, 1923, before a group of science students. There Zhang laid down the gauntlet to those who still championed science in China, notably those at Qinghua and Beijing universities. Borrowing ideas from Rudolf Eucken, Zhang contended that science must be secondary to and complement a viable "philosophy of life" (*rensheng guan* 人生觀). Science of itself, Zhang contended could never provide a vision of life that people could follow because its materialist and objective assumptions ruled out a spiritual vision of human values and never could satisfy the subjective needs of individuals. It was intriguing, however, that Zhang was willing to base his defense of spirituality and moral conscience on the relativity and subjectivity of human values, which in effect jettisoned the universalistic pretensions of the unity of heaven and humanity (*tianren heyi* 天人合一) that had undergirded Chinese traditional civilization.[58]

57 Hu Shi, "Qingdai xuezhe de zhixue fangfa"清代學者的治學方法 (Scholarly methods of Qing dynasty scholars), in *Hushi wencun* 胡適文存 (Preserved writings of Hu Shi) (4 vols. Taibei: Yuandong dashu gongsi, 1968), Vol. 1, pp. 383–412. See also Hu, "The Scientific Spirit and Method in Chinese Philosophy," in C. A. Moore, ed., *The Chinese Mind* (Honolulu, University of Hawaii Press, 1967), pp. 199-222. Because the audience for the latter was Westerners, Hu painted a rosier portrait of China's past in the English version than in the 1921Chinese essay. Cf. Grieder, *Hu Shih*, p. 80n8.

58 See Zhang's "Rensheng guan" 人生觀 (Philosophy of life), first published in *Qinghua*

As Liang Qichao's travel companion in Europe in 1919, Zhang shared Liang's views of what had happened in Europe. In addition, he had studied abroad in Japan and later in Britain and Germany, which put him in touch with many leading European thinkers such as the philosopher Eucken at the University of Jena. For Zhang, science must be complemented by a spiritual vision giving it moral direction and purpose. China's spiritual legacy was rich and must be restored if China was to avoid the materialist excesses of Europe. China's traditions of quietism based on moral self-cultivation, Zhang argued, were sufficient to counteract the overly selfish search for materialistic satisfaction exemplified by modern Europe.[59]

However, another of Liang Qichao's 1919 travel companions in Europe, Ding Wenjiang, found Zhang's views outrageous. Two months after Zhang Junmai's lecture at Qinghua, Ding picked up the gauntlet. As a noted scientist who had trained for seven years in London and Glasgow and received degrees in biology and geology, Ding Wenjiang published a rejoinder in April 1923 to Zhang's lecture. The 1923 "Debate on Science and Philosophy of Life" now began in earnest. Lasting a year, the controversy led to the publication of some 250-300 thousand words on both sides. All the rejoinders and

zhoukan (清華週刊(Qinghua monthly) (December 1923), and included in *Kexue yu rensheng guan* 科學與人生觀 (Science and Philosophy of Life) (2 vols. Shanghai: Dongya tushuguan, 1923), I, pp. 4-10. See also Saitô Tetsurô 齊藤哲郎 , "Qi no ryôan--Chûgoku no 'kagaku to jinseikan' ronsô o chûshin ni"知の兩岸—中國の "科學と人生觀" 論爭を中心に—(Two sides of knowledge: focusing on the Chinese debate over 'science and philosophy of life'), *Chûgoku – shakai to bunka* 中國—社會と文化 8 (1993): 133-55, and Lin Yü-sheng, "The Origins and Implications of Modern Chinese Scientism in Early Republican China: A Case Study – The Debate on 'Science vs. Metaphysics' in 1923," in *Zhonghua minguo chuqi lishi yantaohui lunwenji 1912-1927* 中華民國初期歷史研討會論文集 1912-1927 (2 vols. Taibei: Academia Sinica, Taiwan, Institute of Modern History, 1985), p. 1183.

59 See Kwok, *Scientism in Chinese Thought*, pp. 140-60,, Chow Tse-tsung, *The May 4th Movement*, pp. 333-34, and Grieder, *Hu Shih*, pp. 145-50.

surrejoinders were then published in a memorable collection that went through three printings by 1928 and successfully aired in public the misgivings scholars such as Zhang Junmai had concerning the modernist agenda that scientists and radicals had promoted as in China's best interests.[60]

Ding's initial reply to Zhang Junmai was entitled "Metaphysics and Science" ("Xuanxue yu kexue" 玄學與科學, lit., "dark studies and science") and appeared in April 1923 in issues 48 and 49 of the journal *Nuli zhoubao* 努力週報(Endeavor weekly), which he and Hu Shi had established in Beijing. A distinguished scientist at Beijing University, Ding had initiated the Chinese Geological Survey while chief of the geology section of the Ministry of Industry and Commerce after his return from his studies in Britain. Hence, his credentials as a scientist opposed to the metaphysical humanism favored by Zhang Junmai were impeccable. He accused Zhang of resurrecting the "ghost of metaphysics" (*xuanxue gui* 玄學鬼) in his fanciful and relativistic account of traditional spirituality, human intuition, and humanistic values:

> Metaphysics is really a worthless devil--having scraped along in Europe for something over two thousand years, until he is now coming to find himself with no place to turn and nothing to eat, suddenly he puts up a false trade mark, hangs out a new signboard, and comes swaggering along to China to start working his swindle. If you don't believe it, please just take a look at Zhang Junmai's "The philosophy of life."[61]

[60] See *Kexue yu rensheng guan*. Another series of essays prefaced by Zhang Junmai appeared in Shanghai in 1924.

[61] See *Kexue yu rensheng guan*, I, p. 1, translated in Grieder, p. 150. Cf. Y. C. Wang, *Chinese Intellectuals and the West*, pp. 378-81, and Saitô Tetsurô, "Qi no ryôan--Chûgoku no 'kagaku to jinseikan' ronsô o chûshin ni," pp. 140-42.

Ding Wenjiang would brook no challenge to the legitimacy of science as the framework for modern life. Nor would he allow champions of traditional Chinese civilization, which he held responsible for China's backwardness, to take advantage of the postwar pessimism that had overtaken Europe after 1919 and repackage it as a new humanistic vision of moral values. Those moral values, according to Ding, had been shown to be bankrupt in China and the West by the end of the nineteenth century. Ding accused Zhang Junmai and others of trying to turn the table and claim that science and technology via materialism had bankrupted Europe and would do the same in China. According to Ding, the European debacle had been the result of international politics and not science per se. To blame science and its constant search for the truth for world war one was misguided. Its technologies had been misused by European politicians. The problem was politics, not science.

Zhang Junmai replied with a long article on the philosophy of life in which he invoked European thinkers such as Eucken and Kant to show that the knowledge system based on science was limited to phenomenal experience and thus could not go beyond sense experience and reach the higher levels of human feelings, art, and religion. These were entirely separate and essential domains of human experience that the scientism of Ding Wenjiang refused to acknowledge. Ding replied immediately in May 1923 that Zhang was confusing the difference between spiritual and material matters, which was neither absolute nor inaccessible to human reason. Only the universal applicability of the scientific method, Ding argued, was the means to solve the quandaries of human life. A vague and subjective "philosophy of life" would simply obfuscate human realities.[62]

[62] See Kwok, *Scientism in Chinese Thought*, pp. 142-48,, Chow Tse-tsung, *The May 4th Movement*, pp. 334-35, and Grieder, *Hu Shih*, pp. 150-51.

Liang Qichao, whose impressions of postwar Europe had provided the prelude to the 1923 "Debate on Science and Philosophy of Life," tried to mediate albeit unsuccessfully. He repeated that he had never stated that science per se was bankrupt, but he added that human feelings went beyond science and reason and must be addressed through art, religion, and philosophy. The debate, however, had polarized Chinese intellectuals in Beijing and elsewhere. Hu Shi, who had been ill for much of 1923, had earlier made clear his views on the debate in a review of Liang Shuming's book on Eastern and Western cultures. He noted that the only way to solve human problems was to apply the scientific method to them. Hence for Hu Shi, both Liang Shuming and Zhang Junmai were challenging the very basis of science by appealing to the subjective world of human feelings, art, and religion.[63]

In his preface to the *Kexue yu rensheng guan* volume, Hu Shi added that Liang Qichao's 1919 travel impressions had set off the debate, which had challenged the materialistic foundations of science. The discussions and debates had been useful, Hu added, but in the end he sided with the Guomindang spokesman Wu Zhihui 吳稚暉(1864-1953), who in the second stage of the debate had gone beyond even Ding Wenjiang by acknowledging that science could provide a universal philosophy of life that was purely materialist and mechanistic. Both Hu and Wu held that a "naturalistic conception of life and the universe" was the only possible position that science could uphold. In a dark and essentially chaotic universe, Wu had argued, all sense experience, emotions, art, and religion were the product of energy and matter. Hu Shi contended that China's pretensions to spiritual superiority could not hide away the country's material and spiritual backwardness. Science was the only way out.[64]

63 For Hu's review of Liang's book, see *Hu Shi wencun*, Vo. 2, pp. 158-77.

64 *Kexue yu rensheng guan*, Hu Shi "Xu"序 (Preface), pp. 10-13. The preface can also be found in in *Hu Shi wencun*, Vol. 2, pp. 120-47. See also Kwok, pp. 154-55,. Chow Tse-tsung, pp.

The "Debate on Science and Philosophy of Life" continued for several years, and it is usually argued that the advocates of science gained the upper hand in this brouhaha. Many others joined in the fray, including leading members of the newly established Communist Party, who saw the debate as a chance to promote the scientific pretensions of Marxism. As part of the third stage in the development of the debate from December 1923 to August 1924, for example, Qu Qiubai 瞿秋白 (1899-1935) prepared an essay for *New Youth* (*Xin qingnian* 新青年) entitled "Freedom and Necessity" ("Ziyou shijie yu biran shijie"自由世界與必然世界) in which he stressed the social realities conditioning human agency. Similarly, Chen Duxiu 陳獨秀(1879-1942), one of the founders of the Chinese Communist Party, denied that human agency depended on individual subjectivity in an August 1923 essay for *New Youth*, which gainsaid the claims about the subjectivity of human life and culture made by Zhang Junmai and Liang Qichao. Human choice was based on social and economic causes that could be scientifically delineated as natural developments.[65]

For my purposes here, what is significant is that the followers of both Ding-Hu scientism and Qu-Chen Marxist materialism were champions of modern science. Moreover, the Liang-Zhang humanist appeal to China's spiritual resources never questioned that "science" meant "Western science and technology." When Wu Zhihui created a materialist philosophy of life to complement his view of science, he revealed that the significance of modern science carried over to human agency, which the Marxists also readily accepted. Accordingly, the debate was actually premised on the mutual agreement that the value of modern science in its Western form could not be denied. Neither side wished to appeal to

336-37, Alitto, pp. 126-29, Grieder, pp. 151-52, and Saitô Tetsurô, "Qi no ryôan--Chûgoku no 'kagaku to jinseikan' ronsô o chûshin ni," pp. 142-44.

65 Saitô Tetsurô, "Qi no ryôan--Chûgoku no 'kagaku to jinseikan' ronsô o chûshin ni," pp. 144-46.

traditional Chinese achievements in astronomy, mathematics, or medicine because for each side China had "failed" to develop science. When Liang Qichao appealed for a new unity between Chinese civilizational values and modern science, his position required the amalgamation of European science and technology, that is, what China lacked, with Chinese culture, i.e., what China already had.[66]

5. Qian Mu on the Question of Science and Chinese Culture

Although ostensibly defeated in the realm of public opinion, the vocal revolt against Chinese scientism marked the initial stage of the rise of those whom Hao Chang has called the "New Confucians" (*Xin Ruja* 新儒家).[67] Indeed, Zhang Junmai's later account of Song-Ming Neo-Confucianism, i.e., Cheng-Zhu learning, grew out of his 1920s efforts to demonstrate the importance of China's pre-modern intuitive and empathetic modes of thinking as an antidote to Western materialism. This new frame of reference for the post world war one revival of traditional Chinese thought forces us to rethink the usual theme of the "end of Confucianism."

Instead, we may be able to tie the so-called "last Confucians" of the Qing dynasty to the twenty-five years after the Sino-Japanese War of 1894-95 and up to 1919. This was a time when some Chinese elites for a time lost confidence in their own cultural resources. After 1919, a significant minority of Chinese intellectuals--"New Confucians"--began to appeal in subjectivist terms to the cultural resources bequeathed from the Chinese past,

66 Wang, *Chinese Intellectuals and the West*, pp. 382-83, and Kwok, pp. 160-62, and Saitô, " Qi no ryôan," p. 138.

67 Hao Chang, "New Confucianism and the Intellectual Crisis of Contemporary China," in Charlotte Furth, ed., *The Limits of Change: Essays on Conservative Alternatives in Republican China* (Cambridge: Harvard University Press, 1976), pp. 276-302.

particularly the moral and philosophical doctrines of self-cultivation and the Cheng-Zhu "Learning of the Way" as the foundation of a modern Chinese civilization.[68]

In this light, it is useful to evaluate Qian Mu 錢穆(1895-1990), whose many studies of Chinese intellectual and cultural history in the 1930s and 1940s were very influential in Republican China and among Western scholars. Initially a scholar of ancient Chinese philosophy and thought, particularly the "school of names" (*mingjia* 名家), Qian Mu gradually became a specialist in Song, Ming, and Qing intellectual history. In a celebrated 1930 article that appeared in the *Yanjing xuebao* 燕京學報 (Yanjing University journal), Qian had persuasively critiqued Kang Youwei's 康有為 (1858-1927) notorious position that all Old Text classical learning (*guwenxue* 古文學) had been forged by the Han dynasty scholar-bibliophile Liu Xin 劉歆 (45 B.C. - A.D. 23).

As a result of his devastating breakdown of Kang Youwei's still influential *Xinxue weijing kao* 新學僞經考(Study of the forged classics in the studies of the New dynasty, A.D. 9-23), Qian Mu first joined the faculty at Yanjing in 1930 and then moved to Beijing University in 1931. By 1937 Qian had completed his acclaimed *Zhongguo jin sanbainian xueshushi* 中國近三百年學術史(Intellectual history of China during the last 300 years). In the Preface to the latter he criticized those who called for total Westernization of Chinese

68 See Wang Hui, "From Debates on Culture to Debates on Knowledge: Zhang Junmai and the Differentiations of Cultural Modernity in 1920's China," paper presented at the Workshop "Reinventions of Confucianism in the 20th Century," sponsored by the UCLA Center for Chinese Studies under the auspices of the University of California Pacific Rim Research Program, Los Angeles, January 31, 1998. Cf. Joseph Levenson, *Confucian China and Its Modern Fate: A Trilogy* (3 vols. Berkeley: University of California Press, 1969), and Lin Yü-sheng, "The Origins and Implications of Modern Chinese Scientism in Early Republican China," pp. 1196-97. For Zhang Junmai's later works, see Carsun Chang, *The Development of Neo-Confucian Thought* (Vol. 1: New Haven: College and University Press, 1963; Vol. 2: New York: Bookman Associates, 1962).

institutions and teachings, which indicated that Qian sympathized with those in the 1920s who had called for a renewal of Chinese culture.[69]

In particular, Qian's 1948 work entitled *Zhongguo wenhuashi daolun* 中國文化史導論 (Introduction to Chinese cultural history) concluded with a lengthy section that dealt with the threat science posed for traditional Chinese culture. The key issues in Qian's account were: 1) why science had no intellectual status in traditional China?; and 2) if adopted in China, will modern science damage and ultimately lead to the destruction of Chinese culture? Qian acknowledged that he was presenting his personal views on the vexing question of science in China. The arguments Qian made were divided into ten main divisions, which we will summarize below.[70]

First, Qian argued that pre-modern China had its own traditions of science. He listed Chinese successes in mathematics and the calendar, but he focused on silk, paper, printing, and gunpowder production techniques, many of which were transmitted via the Islamic world to Europe. Qian especially stressed the scientific priority of Guo Shoujing's 郭守敬 (1231-1316) Beijing astronomy observatory established in 1276 and Song Yingxing's 宋應星 illustrated 1637 account of Ming dynasty industrial technology. According to Qian, the last 150 years of Chinese history thus were not representative of earlier Chinese achievements in science, when China had been in advance of the West. Unlike both sides in

[69] See Qian, "Zixu" 自序 (Preface) to *Zhongguo jin sanbainian xueshushi* (2 vols. Taibei, Commercial Press, 1972), pp. 3-4. See also Howard Boorman and Richard Howard, eds., *Biographical Dictionary of Republican China* (New York: Columbia University Press, 1967), Vol. 1, pp. 368-71.

[70] See Qian, *Zhongguo wenhuashi taolun* (Reprint. Shanghai: Sanlian shudian, 1988), pp. 168-81. See also Qian Mu, *Zhongguo wenhua yu kexue* 中國文化與科學(Chinese culture and science) (Taibei, 1970).

the 1923 "Debate on Science and Philosophy of Life," Qian emphasized that science was not uniquely a Western invention or phenomenon.

Secondly, Qian addressed the question of why science's status was so low in pre-modern China that it never achieved the eminence of place associated with science in modern Europe. Here he turned to the cultural argument that both Liang Shuming and Zhang Junmai had made famous in the 1920s. According to Qian Mu, because Eastern peoples, including the Chinese, stressed man's inner life while Westerners accentuated external observation of nature, logical thought did not develop in China beyond the early teachings of the Mohists. Qian added that the Chinese did not have the religious focus of the West which encouraged linking God to nature. Nor did Eastern people stress power to control the outside world, and hence the earlier discoveries of gunpowder, the compass, and movable-type printing in China did not develop much further beyond their early inventions. For example, Chinese later tended to use Western canons when they were needed in warfare rather than develop their own. The compass as an invention wound up having more influence as a superstitious application to siting buildings for fate and was not applied to shipping. Eastern peoples did not value the linkage of knowledge and power that the West had prioritized.[71]

Thirdly, Qian noted that because China was a great empire while Europe was divided into several powers, the latter had tended to be unstable and full of conflict. Such disunity in Europe led to an increased search there for an abstract unity beyond the threats of regional competition. Hence, Europeans appealed to Roman legal thought and Christian theology for political and cultural unity. The European search for a logical and abstract framework in

[71] Curiously, Qian believed that China was the definitive example of the ways of thinking found in the East, and he took no account of India or Japan in his discussion.

turn yielded many independent academic disciplines from which the precise sciences emerged in Europe. In the unified Chinese empire, however, all fields of knowledge were harmonized into a greater synthetic unity. Neither legal nor religious thought in China were applied to a systematic elaboration of the principles of reason, and Chinese consequently had less interest in abstract thought and logical reasoning. To explain change and diversity, Chinese analyzed the principle of all things in terms of an inherent unity defined as a complete harmonious system that was manifested in its worldly differentiation (*liyi fenshu* 理一分殊) into all things and affairs.

Qian Mu's fourth point picked up from his first observation that traditional China had its own science. According to Qian, Chinese had always exhibited their talents in science even though the traditional fields of science did not develop very far. Because Chinese did not stress the external aspects of things and focused instead on their inner workings, they tended to link things to human affairs and use them as in West. But in terms of a rational explanation of the material structure of things, they could not explain why things were the way they were (不知其所以然). Chinese had indeed stressed experiment and proof, but they had never produced a systematic framework for analysis, which made it difficult for later scholars to continue and make progress on earlier knowledge.

As a corollary to points one and four, Qian Mu stressed in the fifth part of his argument that because traditional China had its own science, and since Chinese had always exhibited their talents in science, these two points explained why Chinese had adapted to modern science so quickly in the last century. However, because Chinese after 1850 had continued to stress the efficacy of science they had never achieved a sufficient theoretical understanding of science. This theoretical limitation had been exacerbated by the political and social revolutions in China, which had not provided the stability and order needed to develop modern science and technology quickly and comprehensively.

With point six, Qian turned to the most important question for him: Will modern science harm Chinese culture? This of course reopened the earlier debate between science and philosophy of life. In the end Qian Mu followed Liang Qichao's more ecumenical view that Western science and Chinese culture could be synthesized--but on Chinese cultural terms. Qian noted that China had always been open and receptive to new developments from the outside. Indeed the Jesuit period in China served as an example of China's openness to Western knowledge. According to Qian, it had been the Jesuits on the contrary who were unreceptive to Chinese literati learning while Ming and Qing literati had incorporated many aspects of Jesuit learning successfully. Similarly Chinese literati earlier had adapted to Buddhism and its other worldly focus and produced the Chan school of Chinese Buddhism, but the Buddhists had been unable adapt to Confucianism because of its worldly involvement through statecraft in the affairs of state and society. Still, the unity of the three teachings of Confucianism, Buddhism, and Daoism in China demonstrated for Qian Mu that China's adaptive power contrasted with the exclusivism of Christianity in West.

Qian Mu's point seven picked up the theme of China's receptivity to new developments, which he contrasted with the West, where religion and science had been mutual enemies. In China, Qian argued, the synthesis of both religion and science was possible because of China's lack of exclusivism in each realm of Chinese culture. Thus, science could only add to Chinese culture as a whole--just as science and religion had coexisted peaceably in China. In point eight, Qian added that China needed to exert social and political control to manage the application of science for the good of humanity properly. The Chinese stress on moral correctness to manage the world would ameliorate the West's stress on utility alone, which as the first world war had demonstrated did not include a moral compass for science.

In his penultimate discussion of science in China, Qian Mu underscored in point nine that the Chinese have always stressed the unity of heaven and humanity as the ethical framework in their view of world. This was more of an artistic (*yishu* 藝術) view of things rather than scientific, which brought things in nature and humans beings together into a single vision. Without saying so, Qian Mu was here building on Zhang Junmai's view that China needed to retain its traditional moral-aesthetic unity of knowledge as the basis for science. According to Qian Mu, China had never produced a formal philosophy or religion by Western standards because both religion and philosophy had been subordinated to a unified ethical vision. Thus the Chinese have always stressed unity, while the West has divided up reality into separate fields for study.

Finally in point ten, Qian Mu dealt with the problem of the human sciences, which had lagged behind the expansion of the natural sciences in the West. Mathematics was the root of the natural sciences, Qian contended, but he added that many of the sciences were not completely abstract. Because both biology and the material sciences were concerned with concrete human affairs, they also were linked to the human sciences. Such fields in the natural sciences were similar to economic and political studies because in each the interrelation between human affairs and specialized studies was manifest. Since the Chinese, according to Qian, had stressed the fields now associated with the human sciences, their experience and knowledge in this area could be used to make the natural sciences complementary to Chinese traditional culture. In this way, China's earlier successes in producing theories of philosophy and religion (pre-Qin), articulating political and social models (Han-Tang), and advancing the arts and literature (Song-Yuan-Ming-Qing) would enable China to succeed in the contemporary age of science and technology. The search for peace in China would complement the search for a great unity in the world.

6. Final Comments

Qian Mu's vision of a modern China in which both traditional civilization and modern science would prosper was premised on the assumption that Chinese cultural values and ethical imperatives would take priority over and channel the materialistic and mechanistic dangers of modern science into productive ends that would complement those values and imperatives. In the 1930s and 1940s aftermath of the "Debate on Science and Philosophy of Life," Qian Mu was more in agreement with Zhang Junmai than Hu Shi. Where Qian differed from Zhang and the other "New Confucians," however, was in his realization that traditional Chinese civilization was not merely a source of moral values and a unified, humanistic philosophical vision.

Qian Mu also located in China's past, the native expertise in politics, statecraft, and science, which had always complemented the pre-modern Chinese vision of state and society defined by literati who had honored the Five Classics and Four Books. Thus, Qian appealed to a fuller understanding of the problem of modern science in China and thereby reconnected the twentieth century debate on science to earlier debates in the late Ming and late Qing about how science related to China's past and was not merely a foreign growth. Qian had much in common, then, with late Ming literati, such as Fang Yizhi, and late Qing scholars such as Li Shanlan. None of them privileged the role of science in the West as unprecedented or unique, just further along in Europe.

If science in China had a native history and genealogy, then its adoption by modern Chinese was less problematical than Zhang Junmai and Liang Shuming had realized. Nor was science a fundamental threat to classical values, whether ancient, Song, or Qing in orientation. As a historian of ancient and late imperial intellectual history, Qian was able to understand what late Ming and late Qing scholars had seen in the term for natural studies known in Chinese as *gezhixue*, namely that Chinese traditional learning was compatible with the requirements of science. Hu Shi and Ding Wenjiang at times also voiced an appreciation of Chinese achievements in science and technology before the modern era and saw in the textual scholarship of Dai Zhen, Cui Shu, and others major aspects of the scientific spirit. Hu's and Ding's activist role in the "Debate on Science and Philosophy of Life," however, exposed their appreciation for Qing evidential studies as at best tactical and traditionalistic, not heart-felt.

Perhaps Hu Shi later changed his mind, but in the 1930s, modern intellectuals in Beijing and Shanghai were generally separated into two opposing intellectual camps on science. Some of those who saw in modern science the intellectual revolution of the future, such as Chen Duxiu, would march on in the name of Communism and modern science. Later the wedding between Maoism and science would produce another "Cultural Revolution" in the 1960s. Many of those who saw modern science as the enemy, such as Zhang Junmai, would continue to appeal to the conservation of traditional philosophical values from the borderlands of China in Hong Kong and Taiwan.

There was little room in the 1940s for Qian Mu's more nuanced position about the place of modern science in China. After the volumes in Joseph Needham's *Science and Civilization in China* series began to come out in 1954, however, it was clear, again, that China had had a rich tradition of science and technology, which had been ignored by both the "scientists" and the "New Confucians" who participated in the 1923 "Debate on Science and Philosophy of Life." As the evidence of a rich tradition of natural studies accrued in volume after unrelenting volume of the *Science and Civilization in China* project, it became harder and harder to gainsay it all as superstition or irrationality, Ding Wenjiang's "ghost of metaphysics," or just plain inductive luck, though some still tried. What Needham had

inadvertently rediscovered and revised as "oecumenical science" was the "native origins" of science in China position prominent among classical scholars before 1900.[72]

With the exception of a reformed version of traditional Chinese medicine that has survived and is now thriving as one version of "holistic" medicine, the traditional fields of *gezhixue* in imperial China were destroyed by the impact of modern science. In closing, let me stress a more positive legacy of the demystification of traditional Chinese natural studies at the turn of the twentieth century and its replacement during the New Culture Movement by the mythology of modern European science. By better understanding premodern Chinese interest in nature, technology, and medicine, and the mystifications that undergirded them, we are more perceptive about ourselves and the mystifications that undergird our contemporary idealizations of modern science. In this regard at least, Qian Mu, Liang Qichao, and the "New Confucians" had exposed the cultural limitations in any claim for the omnipotence of modern science.

**** I would like to thank Professor Hsu Kuang-Tai of National Tsing Hua University for his helpful comments and criticisms when I presented the paper at the conference.**

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[72] Besides Needham's *Science and Civilization in China* series (Cambridge: Cambridge University Press, 1954-), see also the articles collected in Nathan Sivin, *Science in Ancient China: Researches and Reflections* (Variorum, 1995), Sivin, *Medicine, Philosophy, and Religion in Ancient China: Researches and Reflections* (Variorum, 1995), and Nathan Sivin, *Traditional Medicine in Contemporary China* (Ann Arbor: Center for Chinese Studies, University of Michigan, 1987).