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SCIENCE AND TECHNOLOGIES TRANSFORMED CHINA

La scienza e le tecnologie che hanno trasformato la Cina

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Abstract

This special issue intends to investigate the transformation and adjustments of technological application and modernization in contemporary China from historical angles. This issue is primarily concerned with the disruption caused by the impacts of western science to traditional Chinese society and culture. Finally, this special issue aims to rebut the western-centric experience and form a global view of the history of science and technology with new approaches.

Questo numero monografico si propone di indagare, da un punto di vista storico, le interazioni tra la progressiva diffusione della tecnologia applicata e il processo di modernizzazione della Cina contemporanea. In particolare, si vogliono analizzare le perturbazioni causate dagli impatti della scienza occidentale sulla società e sulla cultura tradizionali cinesi. Infine, il tentativo è quello di confutare la prospettiva occidentalocentrica per provare a costruire, utilizzando nuovi approcci, una visione globale della storia della scienza e della tecnologia.

Keywords: science and technology, modernization, modernity, medicine, traditional medicine, China.
Scienza e tecnologia, modernizzazione, modernità, medicina, medicina tradizionale, Cina.

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It is known from history that the development of science and technology is part of modernization schemes to many non-western countries. Especially to the Chinese since late Qing periods of the 19th century, the history of modernization is in essence a history of scientific and technological progress. To generations of Chinese under the ideas of modernization, scientific discoveries and technological inventions have brought about new civilizations, modern industries, and the rise and fall of national fates. Countries like China before mid-20th century that have been late with industrialization can, on the one hand, use the results already available in the West and, on the other, being creative to engage scientific knowledge and technological innovations with their traditional legacies.

In the field of science and technology, the process of modernization intensified institutional reform, restructure governmentality, rationally allocate public resources, and enhance educational capability. However, at early stages of catch-up modernization in China, the main problem is to master foreign practices and its successful solution, as a rule, creates a basis for transfer to a ripe western-like society, smoothly applied new knowledge, and participates on equal terms in international technology exchange. In this issue, four contributors offer academic debates on Chinese modernization of traditional Chinese medicine, communication technologies, and maritime services of meteorology from historical perspectives. The authors from both sides of the Taiwan Strait, under a lively academic atmosphere, where curiosity-driven exploration is illuminated various forms of modernity in Chinese schemes of modernization. They again leave many questions along with answers to respond a century-long issues: What was modernization and modernity to modern China?

Modernization and modernity in this special issue

Science has no boundaries. China's endeavors in science and technology need to be more integrated with those of the world, and the world needs a China that is vibrant and able to deliver more in science and technology. Just as collisions generate sparks, exchange and communication enrich imagination and creativity. The above process was often called "modernization" or *xiandaihua* in Chinese (Guo Yanmei 2001, 22-23). Moreover, to encourage the learning and application of science and technologies among the general public, socio-political leaders need to embrace a scientific culture by promoting scientific rationality while cherishing Chinese cultural heritage. To the promoters, enlightened by science, the rich and profound Chinese culture is bound to shine more gloriously. That is modernity or *xiandaixing* in Chinese (Huang Xingtao 2005, 128-136), a respective result of modernization.

The uses and definitions of modernization and modernity constantly illuminated how Chinese was optimistic to the introduction of science and technologies for centuries. However, in western academic circles, modernization, is seen to be a concept derived mostly from, the classical texts of sociology, especially the works of Marx Weber (Whimster, Weber 1980, 361-362). To Chinese definition of modernization, they expect certain steps which together can produce wealth and fortune. Steps which can make everything ready, ranging from goods and resources; to the progress in making labor ready and rapid to serve the centralized political power (Finlayson 2005, 2). Like the Chinese in 20th century, the European used to believe that modernization emerged as a physical process, which left its effect on Western Europe. Early historians also believed that modernization significantly moved outward to bring in other parts of the world, in late 19th and early 20th centuries (Lihehan 2009, 10).

Importantly, these modernization processes did not happen in a uniform manner; in terms of geographical space and social relations, in the framework of a specific social group. This implies that the effect of modernization during the two centuries was not even. Wenxin Xu's article "Scoping Coast Meteorological Service in Chinese Maritime Service" clearly reveals that modernization of maritime services, meteorology in her case-study experienced different rates and kinds of modernization, around the same time when an advanced western technology was inserted to traditional China.

Xu vividly portrayed the introduction of meteorology to fulfill the mission of maritime services, a western institution was specially built by Qing government for its modernization scheme. From the 1840s onwards, with the signing of a series of diplomatic treaties, the Qing Dynasty opened up the coastal and river ports for trade one after another, and as a result, people and ships from Western countries began to enter China on a large scale. However, with a large north-south span, a long coastline, foggy springs, frequent typhoons in summer and autumn, and cold air in winter, China's coastal areas are among the most complex in the world in terms of navigational conditions. To ensure safe navigation, how to deal with weather disasters at sea was one of the main concerns of the time. The most notable of these was the meteorological network established by Chinese Maritime Customs Service (CMCS), linking China's coasts and the world. The network was characterized by both scientific and practical benefits, as it not only accumulated data from East Asia for the development of meteorological science, but also greatly safeguarded the safety of navigation and the smooth running of trade. In sum, Xu states that through the interaction and cooperation of the various institutions around surrounding areas, Chinese Customs had demonstrated its vast organizational and cooperative capabilities, thus gradually established a meteorological service system with both scientific and practical benefits. During this process, the Customs accumulated a large amount of meteorological data, which not only greatly guaranteed the safety of navigation, but also provided great help for the study of historical meteorology in East Asia. The system formed a complex network: from weather data to weather information to human society, thus linking nature, science, technology and human society. In the process, we can see the Customs as a government agency, its diversity, and its work with scientific institutions to promote the cause of navigation and meteorology in the middle and late 19th century to the early 20th century.

Wenxin Xu successfully reveals the process of modernization, implied the positive impacts of introducing western advanced technologies and related science. To think deeper indeed, the complicated relationship between modernization and modernity should be taken into further consideration. Marshall Berman has considered modernity as branch of experience which is special to each person, or awareness that occurred due to a confrontation with the maelstrom caused by modernization. There is a special state or quality at the personal or social level triggered by modernization; that modernity sees of the people who witnessed or went through sharp uprisings. The state of modernity for Berman is of its particular traits. According to him, modern life has its own specific environment, with very different features that strongly belong to itself and not similar to those of the traditional ways of life (Linehan 2009, 11). On the other hand, Matthews Steven argues that the emergence of the modernity was not independent but it was mainly based on history (Mariwan Nasradeen Hasan Barzinji 2013, 47). In his research notes on changing history and impacts of communication in China, Enchao Yong cleverly colored the transformation of communication form in long Chinese history with several unique features of Chinese society and its cultural-politics.

Unlike others who may treat "communication" as an unidentified nor clear concept, Yong immediately defines that communication is about space and time, sending messages across space, consuming time and impacting the human society. He continuously states that communication in China had its unique tradition, differed from the well-known Europa story. Corrodingly to its vast territory, dense population, and socio-political diversity, communication was crucial to link villages, towns and cities while the location of the emperor centered. To its political goals, communication would help the emperor reach every single corner within the Empire. Messengers on foot or driving chariots or riding horses could only deliver the orders step by step. The Empire could endure? It was common and reasonable that the Empire would construct sophisticated communication network to maintain its ruling, while officers would like to take advantages of the same network to deliver their own letters, thus damaged the efficiency of the network, eventually draw the network and the Empire to collapse. Indeed, the rise and fall of ancient Chinese Em-

pires were closely linked with communication network. Every dynasty developed their own pattern of communication methods, and tried to maintain an Empire last forever.

After reviewed the long history of communication in China, Yong indicates that the arrival of British gunboat brought new communication patterns and technologies to China in 1840. Shortly after the Jack flag rose in Hongkong in 1841, the Royal Mail opened up under it to serve the Empire's troops, merchants, and adventures. Soon the western communication system, first Postal Service, then telegraph penetrated into China with the advance of western missionaries, merchants and sailors. After losing some critical battles to British and France, the Chinese government, Qing Empire, gradually realized the advantages of modern communication technology. From 1871 to 1906, Chinese constructed telegraph lines linking major cities, even cross the border connected Russian and Korean. However, tradition did not just perish in front of modern technology of communication. As the new political body of democracy was established in 1912, new technologies of telegram, phone, and newspaper would eventually benefit everyone in one way or another. Modern communication has therefore ignited the most dramatic event in Chinese modern history, the May Fourth Movements 1919. Because the communication network was already open to everyone, and the government had no way to stop the spread of the news. The ripple of the Movement soon spread to the whole country, igniting weaves of political and cultural reforms. In such a short time so many cities joint the aftermath strike shocked the government. As Yong insists that the long game of right to communicate was never stopped till today. New communication technologies constantly appeared. He strongly concludes that as the Chinese government enjoyed the development of modern communication technologies but also tried to restrict the ordinary people's communication range, modern China keeps witnessing tangles between communication freedom and utilization restrictions as the Chinese in thousand years ago.

Scientization and Science to traditional China

Yong's conclusion in fact implies a very interesting coincidence as the title of Bruno Latour's book *We Have Never Been Modern* (Latour 1993) reveals. If we consider Latour is a postmodernist (Golinski 2010, 50-68), it can be said that modernism is connected to modernization and modernity and its development is based on the two; this relation is variable and complicated (Gentile 2003, 44). Generally speaking, one can identify certain internal benefits to modernism considering that both modernization and modernity were globally known, at the late 19th century. Modernity pursues modernism like a response to aspects of life; this made modernism reach an international level. The modernism can be regarded as a response to the sharp shifts molded by modernization and modernity. In brief, modernism recorded the meaning of estrangement of modern humanity, anger, the split of the traditional structure of statement, and official list enclosed the emptying out of both time and space (Mariwan Nasradeen Hasan Barzinji 2013, 49). The feeling of being disorientated is expressed in traditional Chinese medicine; which is an outlet to express medical expressions about the chaos during Chinese Anti-Japanese War (1937-1945).

Kuo-Li Pi's "Traditional Chinese Medicine in Modern Warfare (1937-1945)" discusses the works and actions related to Chinese medicine during the war, explores a long-overlooked topic: the relationship between Chinese medicine, war and country. As Pi indicates, the outbreak of the Sino-Japanese war has led the Chinese medicine community to start thinking about the connection between traditional knowledge and the country's survival as well as the treatment of wounded patients during times of war. The compilation of his analysis allowed readers to discover that Chinese medicine physicians at that time constantly reflected upon its knowledge of surgery, first aid, and drugs from ancient medicine, hoping to play a practical role in wartime. Many past studies investigated the long Sino-Japanese conflicts from late 19th century to 1945 formerly laid particular stress on military and diplomatic aspects (Jansen et al.

1979, 73-89, 191-227). Although there are regional differences (e.g., enemy and the puppet regime zone or Home Front), relevant cultural and historical studies have also been gradually initiated in recent years. Pi likewise intends to explore issues that were seldom investigated in the past studies on history of Chinese medicine using mainly the newspapers, booklets, and private correspondences concerning Chinese medicine during the wartime to identify possible relationship among Chinese medicine, war, and nation. Before the start of the Sino-Japanese War (1937-1945), Chinese and Western medicine practitioners were locked in a battle over the administrative control of medical and health care. Tina Johnson states “These public health efforts shifted in the late 1930s to focus on military medicine and epidemic prevention during the Sino-Japanese War (1937-45) and the Chinese Civil War (1945-49)... rather than thwarting the fledgling public health movement in China, the Second Sino-Japanese War spread it southward and westward” (Lo, Stanley-Baker 2011, 659-668). Although Chinese medicine lacked an acknowledged status and voice in the national health system, the outbreak of the war led to a serious shortage of medical personnel and a lack of pharmaceuticals due to blockades. As the study notes show that the national emergency gave Chinese medicine a new opportunity to develop and to participate in the discussion on national health affairs.

Kou-li Pi’s research on Chinese medicine in wartime China rises a very important question in his conclusion. Is it possible to “modernize” Chinese medicine? Or could Chinese medicine be merged with modern healthcare systems? To respond such question, a lengthy road to integrate Chinese medicine or *Kampo* in Japanese should be carefully studied. In fact, prior to the term “TCM (traditional Chinese medicine)” is made to exclusively represent a medical knowledge and practice in traditional China, the similar medicine was widely used in East Asian countries. The term TCM nowadays is an innovation after the 1950s. Kim Tylor’s *Chinese Medicine in Early Communist China, 1945-1963: A Medicine of Revolution* is the first book focus on the political functions and activities on CCP’s support to Chinese medicine. She asserts that the party policies were very influential in framing the institutions and practices of Chinese medicine, made “TCM” entirely a creature of the Communist state and its shifting priorities. Tylor finally concludes that PRC’s “manipulation” outweighed any consideration of Chinese medicine’s “actual therapeutic value” in achieving the current level of state support (Tylor 2005, 151). In 2008, Elisabeth Hsu publishes an introductory article “The History of Chinese Medicine in the People’s Republic of China and Its Globalization”, in *EASTS*. Her argument highlights how Traditional Chinese Medicine (TCM, *zhongyi*), as invented in the 1950s during a period of nationalism in PRC regime. Like Tylor, Hsu also treats TCM as a communist project and an “invented tradition”. Modified Tylor’s periodization, Hsu classifies the late 1950s was period of the standardization of Chinese medicine and some meditation practices in TCM colleges and hygiene schools, hospitals and clinics (Hsu 2008, 466, 470). However, these studies did not touch various efforts to “scientify” Chinese medicine.

As topics like modernization, scientifically transformation (*kexuehua* 科學化), systematism (*xitonghua* 系統化) and standardization (Lo, Stanley-Baker 2022, 624-741) all become popular interests to English-speaking historians of Chinese medicine. The study of the role of Chinese medicine during the wartime is kept within a relatively circle of Chinese scholars. Two obstacles could cause the situation. Firstly, in her book, Kim Tylor has revealed the main difficulty to study Chinese medicine in wartime China. All the research materials in her book demonstrate considerable vacillation and struggle among the powerful interests in play, and the policy and implementation process were quite “piecemeal” as a result (Tylor 2005, 63). What the condition Tylor faced in writing that book, remains the same to other historians nowadays. Secondly, without proper training and common interests, the war history is commonly dominated by military historians. Compared to Kuo-li Pi’s work, only a Japanese historian Norihito Mizuno issues “Kampo-in wartime Sino-Japanese relations: the Association of East Asian Medicine and the search for a tripartite medical partnership” have slightly extended his research beyond the peacetime to the rumbling periods (Mizuno 2016, 197-214). It is obvious that western readers may requires more information about the linkage of scientific experiments on Chinese medicine between pre-modern and modern China.

Jing Zhao is a qualified Chinese medicine practitioner and PhD student of history. Her article “Rediscussion on the ‘Scientific’ of Modern Acupuncture” analyzes two main external treatment methods of TCM – acupuncture and surgery of traditional Chinese medicine. Acupuncture and surgery of traditional Chinese medicine are the main external treatment methods of TCM. In the early stages, both therapies were based on the “muscular anatomy view” of the body and emphasized the blood body. Early medical practitioners paid more attention to the skin, muscles (sinews), and bones than to the more impersonal ideas of *qi*, meridians, and other such concepts. To ancient doctors in China, skin is the surface of the human body, and its continuous depth is made up of “muscle” and “sinew”. It is important to note that TCM surgery uses a definition of “muscle” differed from Western medicine. The muscular system is occasionally the primary standard for determining where acupoints are located.

Since the Song Dynasty, external medicines like acupuncture and surgery began to be marginalized. Chinese medicine thus went through a transformation of “Confucianization,” tended to be conservative in techniques. Due to the high degree of integration between Confucianism and medical thought, a theoretical connection between the two was established. Neo-Confucianism later unified in the reasoning system of *qi*, *tai chi*, Yin and Yang, and the five elements, the most prevalent Confucian theory of medicine. The theory of acupuncture gradually unified and solidified in this predominately philosophical environment, and the “meridian theory” came to represent the core of acupuncture.

The competition between Chinese and Western medicine heated up during the late Qing Dynasty. Consistent with the development of Western surgery, knowledge closely related to surgery, such as anatomy and bacteriology, was introduced into China and constantly updated. The concept of “disinfection and sterilization” and “anesthesia making pain relief” represented the most different characteristics of Western medicine and traditional Chinese surgery, and was also the key to its curative effect. The absence of “anatomy and physiology” and “disinfection is obviously the weak spots to cause the disappearance of TCM surgery while acupuncture was solely survived. On the early development of “scientific” acupuncture, Meiji Japanese played the key role in its modernization. With the support from the Meiji government, around the 1930s, traditional acupuncture knowledge and teachings were merged with various “scientific” justifications and experiments. During this period, the introduction of “anatomical physiology” and clinical disinfection practice were quick measures to meet the medical trend and improve the status of acupuncture in Japan.

The introduction of anatomy and physiology played a role in exploring the essence of meridians, positioning of acupoints, interpretation of diseases and other aspects, which was also the requirement of “scientization of traditional Chinese medicine” by the supporters of TCM in China. The most significant one was the development of anatomical description of the positioning of acupoints. After the concepts of anatomy and disinfection were acceptable in Chinese society, learning from Japan, Chinese acupuncture practitioners advocate disinfection not only for the need of technical progress, but also for identity transformation, to win the respect of Western medicine and the public. Marking the anatomical structure of the acupoints and clarifying the acupuncture site in imitation of Japanese precedents is required for safety reasons, but this method has no substantive integration with the traditional theory of meridian acupoints. To meet the “scientific” criteria, the “scientific” acupuncture is completed in accordance with the surgical theory and operating rules of Western surgery. In the end, Miss Zhao claims that the development of modern “scientific” acupuncture has not faded way. It is still used in teachings and clinical practices today.

The two articles on Chinese medicine provide the readers an opportunity to look into various debates on the survival of TCM in modern China. During the past decades, Kuo-li Pi also explores the transformation of Chinese medicine in facing the challenge of western medicine since the early Republican era. Focusing on the transformation of concept *qi* in Chinese medicine to meet up western germ theory, he makes vital conclusion that the rejuvenation of Chinese medicine with the of the transformation of concepts on *wenshi shanghan* (warm-damp cold-harm) in the 1930s became popular, might compensate the potential damage of anti-Chinese medicine atmosphere in the 1930S¹.

To the works of Kuo-li Pi and Jing Zhao on Chinese medicine, Kuo-li Pi does not only portrays the transforming scenario of military medicine under the rivalry between traditional Chinese and modern western medicines, but also provides an above topic has never been touched by researchers.

Concluding remarks

In less than twenty years a number of developments have dramatically reshaped much of what was considered as common ideas in the history of science and technology. The intense discussions among scholars concerning a number of theoretical issues, and the subsequent re-thinking of foundational historiographical problems. With more case-studies on non-western societies in hands, researches in the history of science and technology could expanded range of themes for study and up leveled its academic horizon. The focus on Chinese experience of modernization in the scientific peripheries can shed light on how technology and society are transferred and appropriated in both the applied and the theoretical sciences. Historians like the four authors of this issue will be active agents in exploring Chinese cases and themes to illuminate a multi-direction of the history of science and technology that implies a strong interaction within the complicated relationship between modernization and modernity as well as science and scientization. When moving from center/West to periphery/non-west, researchers will immediately realize modernization could be cultural-determined and the success to apply western science and technologies definitely required soils of traditions.

Concomitantly, the proliferation of this special issue along with the information from a variety of original sources could play a key role in defining the contours of the western-centered scope of history of science and technology. The major transformations could thus take place in both the actual case-studies and the inspiration from non-western contexts of the history of science and technology in a number of countries, China in this special issue of the western periphery. All four papers are accordingly done with the latest trends of the history of science and technology in Chinese academic circle. This special issue intends to investigate the transformation and adjustments of technological application and modernization in contemporary China from historical angles. This issue is primarily concerned with the disruption caused by the impacts of western science to traditional Chinese society and culture. Finally, this special issue will not only be the first one in discussing the topic of science and technologies transformed China, but will rebut the western-centric experience and form a global view of the history of science and technology with new approaches.

Note

- 1 For details, please refer to Kuo-li Pi, *Study Notes on Chinese Medicine in Modern Warfare* and Michael Shiyung Liu, James A. Cook, *An Introduction to War, Medicine and Modernity in East Asian Conflicts*, in forthcoming EASTS (2023)

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