Science and Technology in Modern China, 1880s-1940s

Edited by

Jing Tsu and Benjamin A. Elman

BRILL

LEIDEN | BOSTON

Contents

Chinese Scripts, Codes, and Typewriting Machines

Jing Tsu

Abstract

In the late nineteenth century, the Chinese writing system embarked on a path of unprecedented change. In the spirit of scientific thinking, language reformers, inventors, and pedagogues sought to abolish the character script and to replace it with other ideographic, numerical, and alphabetic systems. Swayed by the idea that a universal language in the modern world depended on quick access instead of cultural prestige, they aimed to forge a new script that would not only ease the process of translation but also match the alphabetic writing system in logic and efficiency. They expected the monumental feat to change the very terms on which China interacted with the world. From shorthand to Braille, universal alphabet to word/zi 字 segmentation, modernizing the Chinese language set the material and technological precondition for importing and transforming foreign knowledge. The result far exceeded its original conceit and entered the Chinese language into a race for global linguistic dominance and technology in the Cold War era. This essay discusses the various proposals that were put forth and their technological consequences, including a landmark invention of a Chinese-language typewriter in the 1940s.

Qian Xuantong, twentieth-century Chinese-language reformer and cultural critic, once recalled seeing an advertisement in 1920s Shanghai.[1] Amid the experimental cultural landscape of the Republican period, spotting an announcement for a public séance was nothing too extraordinary. But the growing credibility of such forums, Qian noted with disdain, was alarming. This particular one promised to deliver the spirits of past Confucian sages and literati. Instead of offering moral tales or glimpses into the future, however, the spirits were summoned from the netherworld to do one thing: expound on the virtues of classical phonology. Yet a return to traditional learning was not what the venerable apparitions urged. Nor did they denounce, in the expected tone of the day, the influx of Western knowledge and novelties that made China's own traditions look old, broken, and boring. The spirits rose above such quibbles by seizing on the changing signs of the times. No ghostly voice floated toward the audience from behind the curtains. Instead, they conveyed their messages tangibly in writing, using a mix of non-Chinese scripts, including the Latin alphabet and the Japanese kana.

Qian was not amused. The nationwide campaign to modernize the Chinese language had only just begun, he laments, and already people were ruining a

1 Qian 1999.

 | DOI 10.1163/9789004268784_007

perfectly good science by turning it into a circus of gimmicks. Unlike what the charlatans tried to sell the masses, the national language project was based on empirical observation, phonological laws, and rational implementation. Although Qian was speaking more as a public ideologue than as a linguist, his observation highlights an important intersection between language, writing, science, and technology in modern China. The process was just about to gain nationwide momentum at the time of his writing.

The modern Chinese script reform movement was initiated by a few philologists and amateurs in the 1880s. With a mix of popular passion and ideological agenda propelling the movement, it continued under the state's auspices throughout the twentieth century. The net result was that the face of the script changed, as is well attested by the accomplishments of the simplification campaigns in mainland China in the 1950s and 1960s. A quieter revolution, however, was also afoot. The methods proposed for the script's technological delivery, in fact, have been undergoing continuous revision for more than 130 years. Garnering the most international attention, the simplification campaigns scored major political points at home, as they helped to reduce illiteracy and solidify national standardization. It was the longer scientific turn of the Chinese writing system since the late nineteenth century, however, that made all this possible. The script revolution, which was often pushed into the background while bigger political events seized the stage of twentieth-century Chinese history, turned out to be the lasting one. It irreversibly augmented the global influence and capacity of the Chinese language, thereby opening up a new space for competition and co-optation between the alphabetic and ideographic writing systems.[2] The rivalry reached a high point in the Cold War period, even though its impact is not widely known.[3] During the technological leap between the nineteenth century and the present, from telegraphy to automatic translation, the terms of the arms race between Chinese and English took shape between the 1880s and the 1950s.

In the spirit of the present volume, my analysis of the Chinese script as a transnational history of convertible technology builds on the recent compara-

2 I am well aware of the contended, if not obsolete, use of "ideograph" to designate the written Chinese script. The term has been unpleasantly associated with the philological bias of the Indo-European tradition, chinoiserie, missionary ethnocentrism, and European colonialism. The well-rehearsed critique, however, has been generated outside the context and materials I examine here. I therefore invoke "ideograph" in this essay as a historically laden project that was never stably fixed in itself but evolved with the different contexts of linguistic and technological standardization under examination. For a useful summary of the different ways of naming the Chinese script and their controversies, see DeFrancis 1984, 74–130.

3 Tsu 2010, 49–79.

tive studies of China's history of science, in relation to China's active response to Western science and technology, by taking the conversation in a new direction.[4] First, explicating Chinese science and technology on "Chinese" terms is often criticized for implicitly excluding the "Western," leaving the latter equally unqualified and misunderstood. Some view the polarizing tendency as a methodological problem intrinsic to comparison and suggest broadening the scope, as well as increasing the number of items to be compared. By breaking out of nation- and area-bound niches, it is hoped that no one measure of progress will be unilaterally imposed on different cultures and histories, regardless of their degrees of similarity or difference. On this view, attention to multiplicity and specific contexts helps to remove the Eurocentric lens that so often colors the comparative perspective.

What happens, however, when enforcing asymmetry—and imposing a standard interpretation of that comparison—is precisely the name of the language game? Between the alphabetic and ideographic systems, this question is reengaged at the center of a history of technological rivalry. The encounter between the two writing systems puts into play lasting dynamics of asymmetry and mutual dependence. Taking this as the point of departure, I identify linguistic mediality as a crucial material manifestation of how ways of writing—and the cultures to which they correspond—are made to be different, reciprocal, commensurate, and, finally, independent of these concerns. I take the script medium as an embodied indicator of a global struggle between Chinese and English to be the gold standard. In this case, standardization is more than just about enforcing a framework of normativity or top-down control. Rather, as we will see in the following, it opens the way to mutual accommodation and adaptability, giving currency to enhanced access rather than the exclusivity of accumulated power.

On this view, the terms of asymmetry by which we are accustomed to think about, and to interpret, China's modern history—belated, subjugated, catching up with a vengeance, and so on—are also out of step with how it has evolved on the material-technological front. Much of the existing interest in the nuts and bolts of the modern Chinese-language script has thrived primarily in the study of linguistics, state engineering, and planned education.[5] Seeking new connections that transcend this divided inquiry, I am interested in the popular innovations and unexpected subchannels that propelled the Chinese script into a dynamic role on the global stage. Without falling back on

4 See Elman 2005; Kurtz 2011; Sivin 1982; Lackner, Amelung, and Kurtz 2001; Pollard 1998; Xiong 2011; Guo 1998; Wang Hui 2004, vol. 4, 1107–1279.

5 DeFrancis 1989; Kaske 2008.

the rubrics of nationhood and state building as the predominant measures for the Republican era, I show how the technologization of the Chinese script simultaneously charted out a Chinese, as well as international, trajectory beginning in the nineteenth century. This process produced shared features that were later employed in the language campaigns during the Communist period. In response to the recent proposals to turn to nationalism as a new anchorage for the study of science in the modern period, then, this essay cautions restraint when it comes to the globalization of the Chinese script.[6] The question of modern national language standardization, as I have elaborated elsewhere in the context of Sinophone studies, has been held in constant tension with long-standing desires for transregional and global mediality.[7]

Second, my focus on script systems differs from an emphasis on translation in studies of European and non-European encounters.[8] While the study of how ideas flow and knowledge circulates helps move us past the impact-response model, here I am not interested in what happens to meanings when languages interact or what strategies empower or disempower acts of appropriation. The historical negotiations within the physical medium of script shift the emphasis from interpretive effects to technological materiality—that is, how the latter can structure the former in turn. The way in which writing systems, like the alphabetic and the ideographic, enter into polarity and disagreement raises questions about a priori differences or diverging civilizational mentalities, which are often implied as the deeper causes.[9] To keep the focal point accountable, I take legibility in a real and material sense, in order to gain traction on notions of civilizational difference that otherwise fall back on essentialist, culturalist positions or hide behind the familiar combat of China versus the West.

An inquiry into the Chinese script thus begins anew here. For most of the modern period, the Chinese logograph was singly pointed to as the writing system that was the least prepared for modern, scientific advancement due to its cumbersome physical shape. The suggestion has been provocative enough to incite heated and protracted debates. Without taking the same bait, however, one might ask how the fate of scientific thinking in China came to hang on a matter of a few less or a few more strokes. What kind of experiments were being carried out within the Chinese writing system that primed it for an alphabetic overhaul? What does it mean to refer to a "Chinese" or a "Western" writing system when such attributions are the effect, rather than the cause, of

6 Elman 2007; Fan 2007; Hu 2007; Schmalzer 2007; Shen 2007; Wang Zuoyue 2007.

7 Tsu 2010.

8 Huters 2005; L. Liu 2004.

9 Havelock 1987; Castells 1996; Lloyd and Sivin 2002.

a possible conversion between alphabetic and ideographic systems? Such a perspective articulates a view outside the silos of the "area studies" model that underlies parts of China studies, as well as a concern that bends the general disciplinary frame of the history of science, still thicker around the hard sciences and the European tradition than elsewhere, toward questions of the material, intercultural connections on the fringe. To build a possible bridge to a broader comparative conversation, then, I will examine three related contexts: (1) the debates on China's lack of scientific capacity due to its linguistic alterity; (2) the search for new Chinese writing systems that had little to do with Chinese; and (3) the attempted resolution to these historical debates by turning ideographicality into a virtual and global alphabetic medium.

I "Why Science Didn't Happen to Ideographic Writing—or Didn't It?"[10]

Few periods have witnessed more imaginative inferences about the Chinese script than the twentieth century. Gazing at it upside down—due to a typographical error or lack of linguistic knowledge—Marshall McLuhan saw "a vortex that responds to lines of force … a mask of corporate energy."[11] Rivaling Ezra Pound, who once proposed that the Chinese script was "alive and plastic" and "not only the forms of sentences, but literally the parts of speech growing up, budding forth one from another," McLuhan belongs to a long line of illustrious commentators who treated the Chinese character as ideal alterity.[12] Going back to the seventeenth century, the Chinese ideograph, with designations ranging from "Real Character" to the "mother tongue" of God, was invested with the power of spiritual salvation and direct communion.[13] While it is easier to discredit, as many have, how McLuhan deployed the ideograph in his popular theory of the medium and the message, it is harder to dismiss the pleas voiced by the Chinese themselves. Chinese writing had long been consecrated with mystifying powers. From divination to recalling presence, the origin of writing partook in the formation of cosmic patterns in the universe.[14]

10 To a different end, I adapt this phrase from Nathan Sivin's provocative and seminal contribution to the pro and contra Needham paradigm debates. See Sivin 1982.

11 McLuhan and Parker 1968, 38.

12 Fenellosa 2008, 50.

13 Wilkins 1668; Webb 1669.

14 Lewis 1999. For a rich literary rendition of this myth against the backdrop of Chinese writing in diaspora in the early 2000s, see Malaysian Chinese writer Zhang Guixing's novel, *Qunxiang* (*Elephants*)

Given the long-standing significance and consecrated cultural status of the written Chinese script, any systematic change would be traumatic and was, for that reason, unthinkable for most of China's long history. Yet people started to contemplate just this possibility around the turn of the twentieth century. The survival of modern China, many urged, depended on what happens to its written script. Arguments of cultural heritage notwithstanding, the complexity of the character script, in contrast to the alphabet, was becoming a liability. While enforcing a unified script since the third century had served the purpose of centralization well, supporters and detractors alike noticed that the dogged adherence to character stroke orders, and the elitist cultural distinction reserved for the utmost mastery of its massive inventory, were getting diminishing returns. In the face of new international threats and old internal linguistic divides, China was plagued by the growing gaps in spoken topolects between the north and the south, on the one hand, and pressed by the outside world into international intercourse, on the other. To best interact with the world, one needed to, among other things, assimilate its modern forms of scientific knowledge. Developing a universalizable linguistic medium was vital. Influenced by missionaries' expressed woes of learning the difficult language, but adding their own sense of urgency, script inventors such as Lu Zhuangzhang, Shen Xue, and others treated the script question as a matter of life and death. Risking incarceration and sometimes even their lives, they set out to change the face of Chinese writing. Who had the time anymore, after all, to learn the right stroke orders when it was more pressing to make time for learning mathematics and physics? Common wisdom in the late nineteenth-century Chinese popular medical urbanscape had its own take on the subject too. Faulting the logograph for using up memory and clogging the brain, people welcomed and consumed brain tonics of different varieties in order to treat this very vulnerability that is particular to the modern age.[15]

If the logograph embodied for the Chinese a moment of widespread crisis at the close of a dynasty, it shouldered an even greater blame from the perspective of civilizational advancement. This argument resurfaced among Greek classicists in the mid-twentieth century, when the questioned relationship between orality and literacy invited speculations on whether a writing system like the alphabet was responsible for the advancement of philosophy and science in ancient Western civilization. Eric Havelock, once in the intellectual circle of McLuhan, and others argued that the advent of the Greek alphabet, superseding its Phoenician origins, was the first writing system to successfully

15 For a treatment of the growing phenomenon of neurasthenia in general, see Shapiro 2000.

reduce ambiguity between physically similar words by developing the capacity to represent any phoneme.[16] It was able to break down all semantic and phonetic units, then recombine them to represent any sound in spoken speech. This system of adaptation spurred the Greeks into developing higher and higher levels of abstractions that formed, in short, the prerequisite mental framework for science. While this view has been challenged by other classicists, it has nonetheless tapped into a long-standing popular prejudice.[17] That Chinese is not ideographic but, in fact, possesses both phonetic and pictorial components and is more binomial than monosyllabic remain nuances that are more important to the specialist than to the everyday reader.

One of the most concerted efforts to restore philosophical and scientific integrity to the Chinese language in its own right is presented in the two volumes of *Science and Civilisation in China* published in 1998 and 2004. Outlining the methodology, Christoph Harbsmeier gives an exclusive focus on language its due weight:

> The theory and practice of science and technology are inextricably bound up with language and logic. Scientific insights become transmittable cultural heritage to the extent that they are articulated in language. The insights add up to a scientific explanation to the extent that they are organized into a coherent argument. The explanations add up to a scientific system to the extent that they are organized into a general logical scheme.[18]

Picking up where Needham left off in volume 2 of *Science and Civilisation in China*, Harbsmeier points to language as the basic condition for articulating argumentation and explication.[19] This may at first appear as little more than an obvious fact. If the transmission of science from one cultural context to another means having to convey it in some written or verbal form, then any degree of language barrier could make the difference between having and not having this knowledge. Harbsmeier has something more specific in mind, however. Like pieces of a puzzle, language is further divisible into units of semantic conveyance, as in sentences or clauses, which can reflect the larger cognitive process in the Chinese language. Grammar, on this view, constitutes the diagrammatic logic of not only the structure of writing but also thinking

16 Havelock 1987.

17 Lloyd and Sivin 2002.

18 Needham and Harbsmeier 1998, i.

19 See Needham 1956, 199; Boltz 2000.

itself. Hence, for Harbsmeier, focusing on lexical changes in the act of translation would get at only the surface of the problem. He makes plain that the purpose is not to show how the Chinese have "logic" too, or that they have a theory of language that can be juxtaposed to European philology. Rather, he is careful to distinguish between complementary cultural differences and matching categories that do not exist. To this end, he uses a simple analogy for grasping the first misstep that can occur in approaching culturally distinct epistemic categories: though everyone can count, not everyone ends up developing a number theory. Just because logic exists, Joachim Kurtz's compelling study shows, it need not manifest along only one path of rational sense-making.[20]

While resonating with long-standing metaphysical questions about modes of perception and cognition, this important reminder goes beyond the assertion that culturally specific ways of thinking are "different" or on their own terms. It opens the way to the more critical path of asking how the idea of *different* writing systems, *different* thought processes, was emplaced as a cornerstone or standard in staging such evaluations. Any attempt at a comparative study of science in East and West inevitably comes up against the chosen terms themselves as a methodological constraint. This point was not lost on those who first labored over the question of the technology of Chinese writing on the ground. And they took a decidedly experimental approach to close the comparison gap.

II How Chinese Almost Lost Its Script

Much of the scholarly debate on ideographic versus alphabetic writing systems, in fact, could have been preempted before the twentieth century got under way. In 1900, twelve years before Beijing Mandarin became the national language (*guoyu* 国语) of the new Republic of China, a wanted Chinese fugitive returned from Japan. Disguised as a Buddhist monk from Taiwan named Zhao Shiming, he stole across the border of the Qing Empire into Shandong Province, following a route south to Jiangsu before traveling back north to the city of Tianjin. All the while, he had with him a secret document: a draft proposal for a new phonetic writing system for the Mandarin dialect of Chinese, called the "Mandarin alphabet" (*guanhua zimu* 官话字母), which he had developed during his two years of exile in Tokyo.

While his story is more exciting than most, Wang Zhao—the fugitive's real name—is but one of more than a score of inventors and pedagogues who

20 Kurtz 2011.

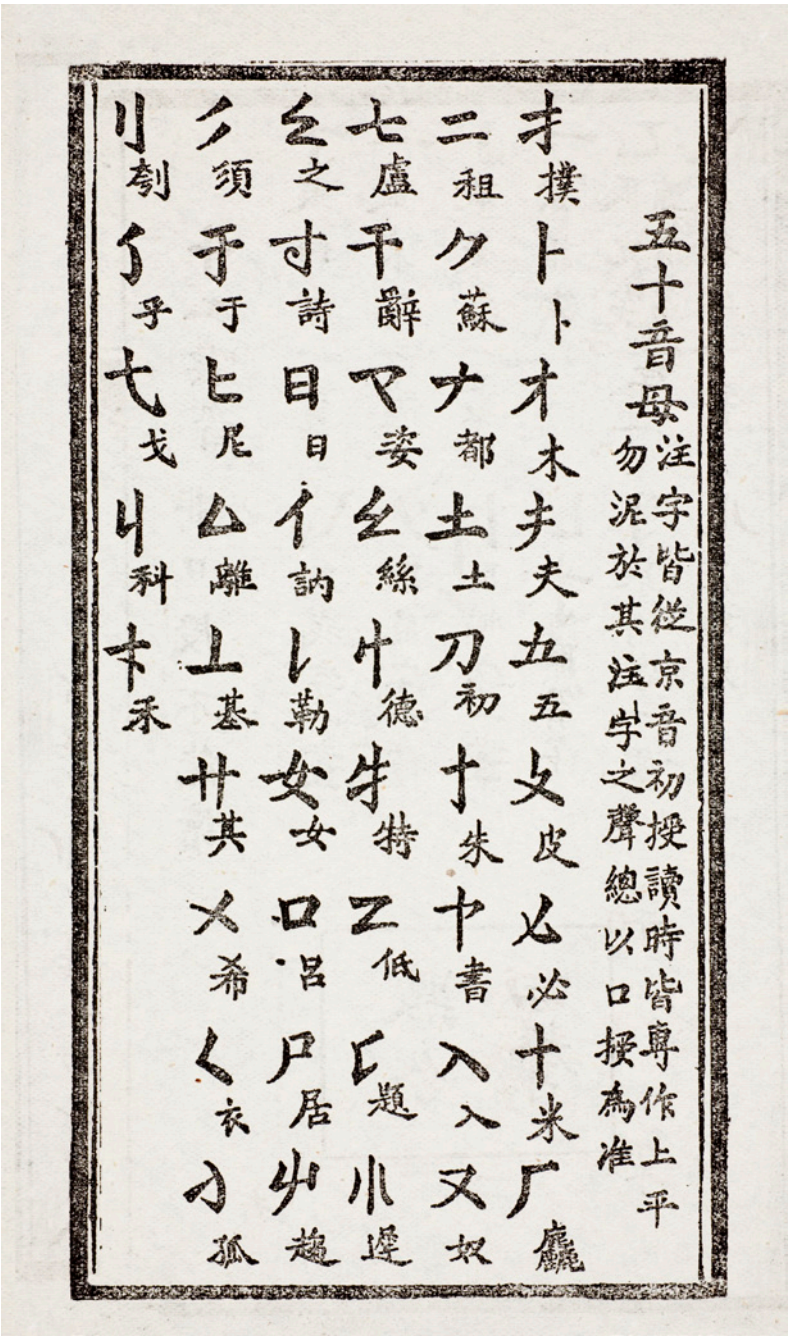

FIGURE 1 *The fifty vowels of the Mandarin alphabet.* (FROM WANG ZHAO 1903.)

attempted to change the Chinese writing system in the late nineteenth and early twentieth centuries. A largely overlooked group of impassioned pedagogues and practitioners, they held that the Chinese script was structurally inconsistent with the conditions of modernity. The amount of labor required to master the cumbersome writing system was to blame, according to one script inventor in 1908, for China's "evolutionary belatedness."[21] This complaint was, of course, not unprecedented. It followed a well-known trail of woes left by foreign missionaries since the time of Matteo Ricci and others.

Instead of relying on the Romanization schemes that the missionaries had developed for the purpose of proselytization, however, late Qing script reformers saw the Chinese script itself as having a decisive role to play. Left unimproved, they argued, the ideograph would stunt any form of modern learning—especially in the areas of technology, translation, commerce, and communication. If a key could be found, on the other hand, in the acoustic patterns beyond the written script to make it easier to learn, a whole new world would "open up" (*tong* 通) with it. Script inventors and language reformers, seeing an opportunity and infused with the spirit of science and empiricism, responded with an array of imaginative, at times esoteric, prescriptions. Some proposed replacing the logogram with alphabet letters, while others studied shorthand, notations for the deaf-mute, and numeral-based systems.

Ni Haishu estimates that, between 1892 and the 1910s, more than thirty script schemes were proposed. There were certainly more. Most of the ones Ni knew about were reprinted mainly in the late 1950s, in connection with the Chinese government's revived interest in simplified orthography. What has remained virtually unknown is that the proposals for a new orthography were being peddled abroad as well, bypassing the scrutiny at home altogether in attempts to reach a world audience.

One such example is a rare Cantonese phoneticization scheme in shorthand devised by a man from Hong Kong named Mok Lai Chi, who was a member of Pitman's Phonetic Society. Isaac Pitman—the inventor of modern phonography (shorthand)—published it in his *Phonetic Journal* in 1893. This was only one year after Lu Zhuangzhang's *A Primer at a Glance: Chinese New Phonetic Script in the Amoy Dialect* appeared.[22] Ni Haishu, and others citing his authority, believe that Lu was "the first person who had a concept of the pho-

21 Liu Mengyang 1957 [1908], 84. The acknowledgment of China's "evolutionary belatedness," however, was not always fatalistic, as it was often made in relation to the even less fortunate civilization that had fallen under the sway of Western imperialism. See Tsu 2005, 32–65.

22 Lu Zhuangzhang 1956 [1892].

netic script and devised a phonetic scheme in China."[23] While Mok did not use the Latin alphabet as Lu did, his phonography was a means to the same end. Mok was already working on his scheme prior to May 1892. This certainly disputes the commonly held belief that Cai Xiyong, who published his *Phonetic Quick Script* in 1896, was the first to develop a phonetic script for the Chinese language based on the shorthand system, and it puts into perspective other schemes that followed a different topolectal or tonal paradigm.[24]

The interest in phonography was widespread and surfaced beyond China's borders. In 1892, a Singaporean Chinese, Lim Koon Tye, printed a request for exchange and correspondence with an English-language phonographer in any part of the world in the *Phonetic Journal.* It is clear that change was in the air. Many contemplated the possibility of coordinating sound and script in the different Chinese dialects in a new way. Rushing toward this new frontier, they sought out different networks and resources to identify the appropriate audience.

Mok, for instance, had originally intended to limit his study to traditional rhyme dictionaries in order to figure out a similar system of phonetic classifi-

23 Ni 1948, 32.

24 Cai Xiyong 1956 [1896]. Cai was a translator who accompanied Emissary Chen Lanbing to the United States, Japan, and Peru in the 1870s. He spent more than a decade drawing up a tachygraphy-based Chinese shorthand system. Having witnessed the extraordinary efficiency (two hundred words per minute) of the use of Lindsley shorthand (*suohen* 索痕) in US congressional proceedings during his four years in Washington, D.C., Cai welcomed a similar prospect for the then roughly 40,000 Chinese characters. He encountered shorthand again in Japan as *shagenshu* and meticulously studied various manuals and handbooks related to the subject. Cai is often credited with the foresight of having developed a phonetic script using the Beijing-based Mandarin dialect, which was later chosen for the national language. Cai, however, had originally intended the quick script to serve as a tool for implementation after the national language had been chosen. The fact that the Latin alphabet can be used to spell and pronounce the different European national tongues inspired Cai to do the same for the various regional dialects in China by supplementing Sinograph recognition with an easy phonetic scheme that can notate several characters in one continuous stroke. Like many others, he first tested his ideas on his own family, who reputedly, within a month, mastered the scheme. His eldest son, Cai Zhang, carried on his research after his death. Improving upon it with Isaac Pitman's shorthand, and in collaboration with a Japanese stenographer, Cai Zhang published *Chinese Stenography* in 1934, which became the founding textbook for modern Chinese shorthand. Other similar shorthand schemes include Li Jiesan's *Min Dialect Quick Script* (1956 [1896]), which was a Min-dialect adaptation of Cai's northern-dialect formula, and Wang Bingyao's *Table for Phonetic Script* (1956 [1896]). Cf. Gitelman 1999; Downey 2008, 103–154; Kreilkamp 2005.

FIGURE 2 *Example of "The Lord's Prayer."* (FROM MOK 1893, 470.)

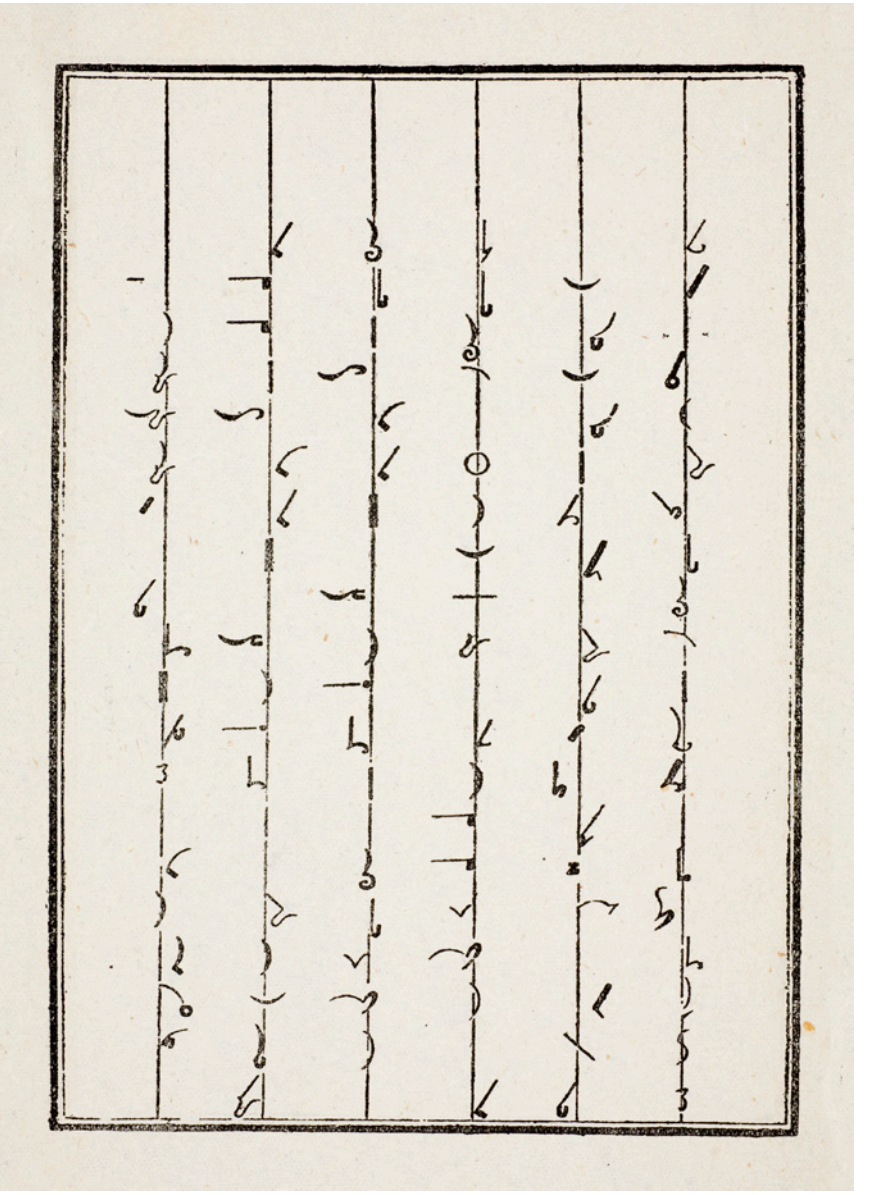

FIGURE 3 *"Imperial Edicts for General Instruction" in "quick script."* (FROM CAI XIYONG 1956 [1896], 36.)

FIGURE 4 *Li Jiesan's "quick script in Min topolect," using as a teaching text Confucian scholar Fang Xiaoru's (1357–1402) treatise "A Discussion of Profound Contemplation"* (SHENLU LUN). (FROM LI 1956 [1896], 67.)

FIGURE 5 *Chen Qiu's "Seven-Tone New Script of Europe" was based on the five tones of the ancient pentatonic scale in Chinese musicology—gong* 宮, *shang* 商, *jue* 角, *zhi* 徵, *yu* 羽*—and two additional tones derived from gong and zhi. The five tones roughly correspond to the keys of C, D, E, G, and A in the Western diatonic scale. The phonetic scheme is called the new script of "Europe," because Chen viewed Asia and Europe as belonging to the same continent, with China at its eastern edge.* (FROM CHEN 1958 [1903], 64.)

cation. In May 1892, however, he read an article in the *Phonetic Journal* about a Chinese-language shorthand in the Pitman style created by the Reverend Alexander Gregory. Gregory was a missionary of the Presbyterian Church in Amoy who while learning Chinese conceived the idea that Pitman's shorthand "might be transferred [into Chinese] almost in its entirety, [character] strokes used for the consonants, and a somewhat increased number of vowel signs being put in round the outline thus obtained."[25] He further studied, as most missionaries did, local rhyme books in order to map the dialectal syllabic properties onto Pitman's shorthand system. With a few adjustments, he submitted his findings to the *Phonetic Journal*, hoping that it would "be useful as a starting point for others." Greatly inspired, in a letter to the *Phonetic Journal* in 1893 that was written in "beautiful phonography," Mok passionately voiced his own aspiration to follow suit and "to assist a phonographer to read, speak, and write Chinese by means of the simple phonographic signs." People found Mok's method so useful that, Mok describes, "schoolboys and clerks [were] asking me to open a shorthand class in the evening, which I intend to do."[26]

Four months later, Mok opened the Hong Kong School for Shorthand, attached to the Morrison English School, in which he taught, pro bono, a curriculum that included Pitman's shorthand, translation from English to Chinese, grammar, composition, and letter writing. It was designed for students interested in going into government service. His scheme, received as "a very ingenious adaptation of Pitman phonography to Chinese," comprised slightly fewer than fifty vowel signs and consonants, with provisions—light dots, lines, and word positions—for marking the nine tones in Cantonese.[27] At the time of his course offering in September 1893, his manuscript "Chinese Phonography, an Adaptation of Phonography to the Chinese Language in the Cantonese Dialect" was "in preparation."[28] In November of the same year, he posted a notice in the journal, seeking the help of potential collaborators and lithographers in producing the book.[29] It is unclear whether it was ever published.

From these examples, it is apparent that there were different developments in phoneticization going on at the same time. Some, like Mok, sought out support from Western phonographers and missionaries, while other Chinese script reformers saw their projects as distinctively Chinese and were implicitly disdainful of the missionaries' efforts. Regardless, the shorthand system

25 *Phonetic Journal* 51 (1892): 325–326.
26 *Phonetic Journal* 52 (1893): 290.
27 Ibid., 389, 470.
28 Ibid., 590.
29 Ibid., 722.

attracted a following and curiosity. In response to a reader's query in the February 4, 1893, issue of the *Phonetic Journal* regarding whether a phonographic system had been developed for the Cantonese dialect in China, a correspondent in Glasgow forwarded a letter from the Reverend W. H. Murray in which the latter described the use of an adapted version of the Pitman shorthand in Beijing for copying parts of the Bible for reading exercises.[30] Murray was a Protestant missionary who had been a resident of China since 1871 and had founded the School for the Blind in Beijing.[31] He spoke with authority on the subject of phonetic scripts, having invented in 1879 the Numeral-Type system for teaching literacy to the blind based on a classification of 408 distinct tones, or syllables, in Mandarin Chinese. He later modified the system for the purpose of general literacy, using black lines instead of the raised dots of the Braille system, to accommodate the needs of sighted but illiterate Chinese.[32] By 1895, it was reported that the use of Pitman's shorthand was evident in mercantile offices and schools in Shanghai.[33]

This broad view of the different motivations, the technical sources, and the international network for revamping the Chinese writing system pinpoints a new translocal and global locus for understanding the significance and ambition of the phoneticization movement of the late Qing dynasty. For one thing, it far exceeded the later scope of national standardization. Recent attention to this project has largely been restricted to the representative figures of the movement—such as Lu Zhuangzhang, Shen Xue, Cai Xiyong, and Wang Zhao—and has faithfully adhered to Ni's standard accounts.[34] Indeed, by the time Lu Zhuangzhang's *A Primer at a Glance* appeared in 1892, the question had already taken on a different color.[35] Unlike Mok's, Lu's scheme was designed to supersede missionary phoneticization in open rivalry.

Born in the first year of the First Opium War in 1840, Lu Zhuangzhang was raised in Xiamen, where missionary Romanized versions of the Bible were in circulation as early as 1852. He did not do very well under the traditional civil examinations system, which afforded him little prospect of official distinction. He converted to Christianity and sought out opportunities in the missionary community. While studying the Bible and learning about the Western sciences, his daughter later recounts, he became deeply involved in the question of

30 Ibid., 114.

31 Dennis 1906, vol. 3, 378.

32 Gordon-Cumming 1898, vii–x.

33 *Phonetic Journal* 54 (1895): 278.

34 Kaske 2008; Cheng 2001; Mair 2000.

35 Lu Zhuangzhang 1956 [1892].

alphabetic writing and its possibilities for reforming the Chinese ideograph.[36] At the age of twenty-one, he went to Singapore to study English for about four years. Afterward, he returned to Xiamen and worked as a language tutor for Chinese and foreigners before acquiring a post assisting John MacGowan of the London Missionary Society. Together they compiled the *English and Chinese Dictionary of the Amoy Dialect*, which appeared in 1883. While working under Macgowan, Lu had the chance to work extensively with the missionaries' system of "speech-sound script" (*huayin* 话音), which used Latin letters to transcribe local dialects. The missionary Romanization schemes drew from local sources, in particular the fifteen tones already identified in the earliest extant rhyme book of the Zhangzhou dialect in southeastern Fujian Province.[37] Having perused the same sources and studied their transposition in the process, Lu came to believe that he could develop a better system.

Having gained more confidence from knowledge and exposure, Lu grew critical of the missionaries' endeavors. In the preface to *A Primer at a Glance*, he takes issue with the speech-sound script. Not only did he find the missionaries' reliance on the fifteen tones insufficient, but he also found their schemes structurally wanting. The speech-sound script required several letters to convey just one sound, leaving some words physically longer than others, uneven instead of aesthetically streamlined. To save space, Lu proposed a system of fifty-five *zimu* 字母 (alphabet letters), on the basis of which each character would be spelled out with exactly one letter for the rhyme vowel and another for the rhyme ending. Lu adapted the fifty-five *zimu* from the Roman alphabet, a method that a number of other reformers opted for as well. While some letters appeared to be Latin in origin, each had its own distinct pronunciation. Of the fifty-five letters, thirty-six were based on the Amoy (current-day Macau) pronunciation, nine were taken from the Zhangzhou and Quanzhou dialects, and the remaining represented composite tones from other regions. Lu used local rhymes and songs as practice lessons throughout the manual. Despite their exposure to foreign languages, grammar, and transcription systems, all script reformers cut their teeth on the well-established corpus of indigenous linguistic and phonological materials.

A major selling point of Lu's scheme was its purported ease of learning. It was designed to spare the brain unnecessary exertion, even dispensing with the presence of a teacher by allowing the student to recognize the intended Chinese character, now spelled out in Latin letters, on his or her own based on

36 Lu Tiande 2000, 77.

37 Van der Loon 1992, 15–57.

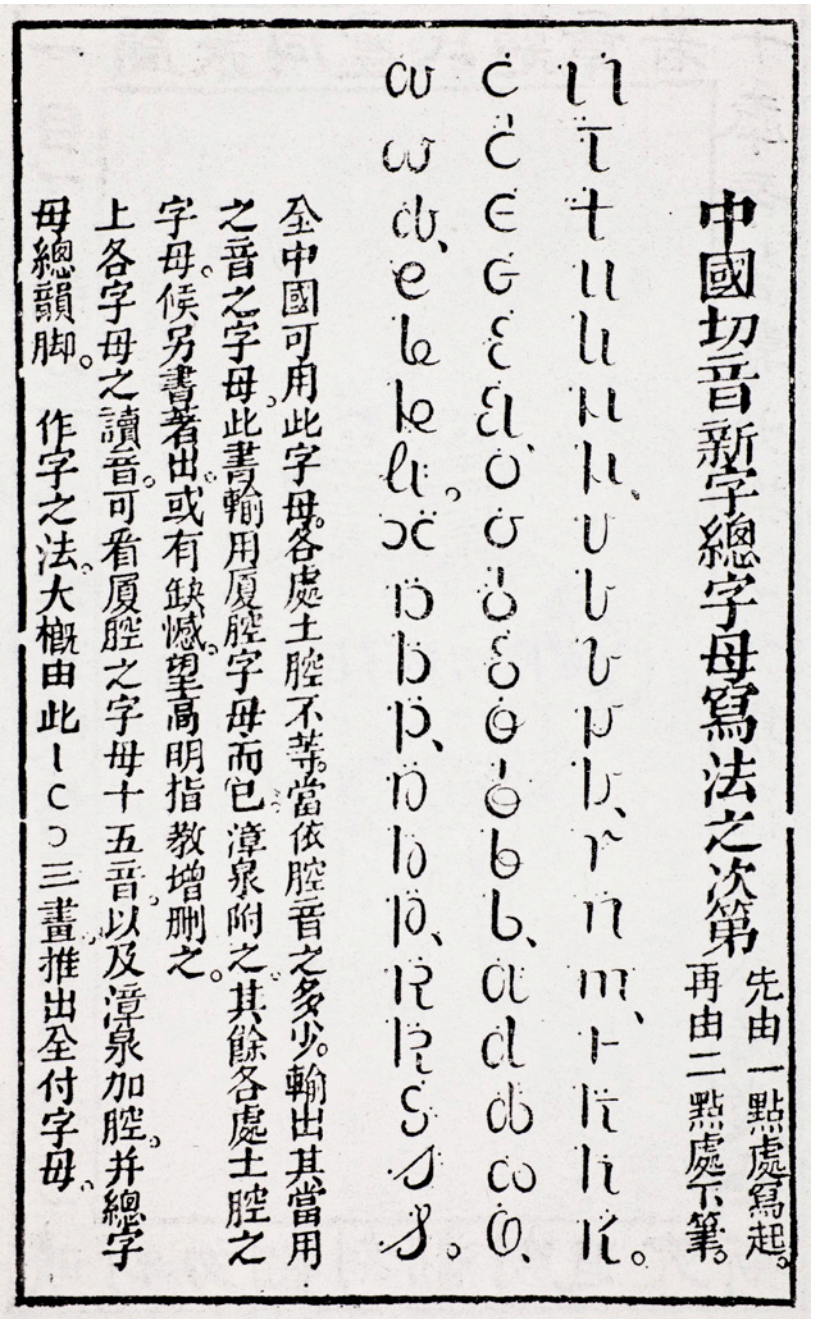

FIGURE 6 *Lu Zhuangzhang derived his fifty-five alphabet letters from the Roman letters l, c, and ɔ (open o). The scheme can be used to represent different southern dialects (Xiamen, Zhangzhou, Quanzhou, Shantou, Fuzhou, Guangzhou), but it uses the Nanjing dialect as their shared standard tone.* (FROM LU ZHUANGZHANG 1956 [1892].)

a few rules of thumb.[38] Lu anticipated the method's rapid spread throughout the nineteen provinces in China, its effect rippling through to the outside world. The orthography, however, did not at first succeed in being easy to learn. Other than the inventor himself (whose passionate familiarity with his own innovation made him immune to the growing complexity of added rules, principles, exceptions, and clauses) and his next of kin (who are generally the first test subjects and predictably compliant), few could pick it up in a few weeks, as advertised. This was a common problem that beset almost every new script proposal, sending its inventor back to the drawing board for a second, and often third and fourth, try. Even a trained linguist could still fail at grasping its basic principles. Linguistic historian Luo Changpei, in a not-atypical response, found Lu's scheme cumbersome and esoteric, "neither Chinese nor Western."[39] Later, while living in colonial Taiwan, Lu himself came to see the design flaws and attempted to recalibrate the system by using the Japanese kana syllabary. By then, however, there were many more new competitors on the scene.

Thwarted attempts and redoubled efforts aside, the ingenuity of the various script schemes can be gauged, not in how well they were received, but in how far they stretched the imagination. Of the many factors that could have doomed any of these innovations, however, the political climate of the tumultuous close of the last dynasty and of the bloody path toward the founding of the Republic was enough to preempt a definitive realization. The lasting significance of Lu's innovation lies not so much in the phonetic scripts as in the principles that went with them. Early on, he identified the importance of grouping characters according to their most frequent usage in the absence of punctuation marks, something comparable to modern-day segmentation in computational linguistics. A prerequisite to automatic translation from the early days of machine translation to current-day Google Translate, such a method of marking the basic semantic units of the Chinese language prepared the way for its conversion into different languages. Whereas the Latin alphabet allows for the separation of words by spacing, Lu explained, Chinese writing is composed of discrete characters, traditionally unaccompanied by visual cues that would help distinguish between semantic units (*ci* 词), which frequently consist of more than one logogram. Recognizing the need to account for the syntactical subunits, Lu used a dash to connect the phoneticized scripts within the same semantic cluster. Other script inventors followed suit by alternatively using parentheses and underlining.

38 Lu Zhuangzhang 1956 [1892], 3.

39 Luo 1934, 12.

Two lessons can be drawn from the late Qing script reform's ingenuity and failure. Despite their innovativeness and the significant advantage they offered in the long run, the various script schemes failed the practical test. The window for radical change—which some saw as the very abolition of the Chinese-character writing system itself—that opened with the cataclysmic fall of the dynasty was too small to allow gradual reform. The rise of nationalism essentially drew the movement to a close. It marked a conservative shift from fundamentally transforming the shape of the Chinese language to standardizing its geographically diverse pronunciations. Despite its general untimeliness, the late Qing script reform left unresolved certain issues that became new venues of pursuit. The recognition of a fundamental spatial disparity between segments of Chinese characters and segments of alphabetic words left behind a monumental challenge: the convertibility of the Chinese character script as a host medium for alphabetic languages, particularly English. This technical quandary was ingeniously confronted in the 1940s.

III Alphabetizing Chinese

The concern during the late Qing period that the Chinese writing system was not conducive to modern thinking took a very different turn in the ensuing decades. On April 17, 1946, the Chinese writer Lin Yutang filed an application with the US Patent Office for a Chinese-language typewriter. The design, which took him fifty years to conceive and to build, realized the vision of the late Qing script reformers in typographic technology. His venture relied on an assemblage of different means of production from China to Europe and the United States. He put his idea to the test in 1927 by conducting an empirical study using an instruction manual on general mechanics and an English-language typewriter. In 1931, he spent time working with engineers in England and subsequently brought back an early template of his invention, custom-made in Xiamen. The casting mold for the type was customized in New York's Chinatown, and Lin found a small factory in the suburbs to make the special parts for his ideographic writing machine.

While Lin's literary success is well known, his technological experiments have won only passing mention. From 1930 onward, he authored numerous nonfiction and fiction works and introduced Chinese culture and civilization to the Anglophone audience. His commercial success in the United States further extended his reputation as one of modern China's best essayists. Nearly all his English-language works were published by the John Day Company with the help of Pearl S. Buck and her husband, Richard Walsh, both of whom were

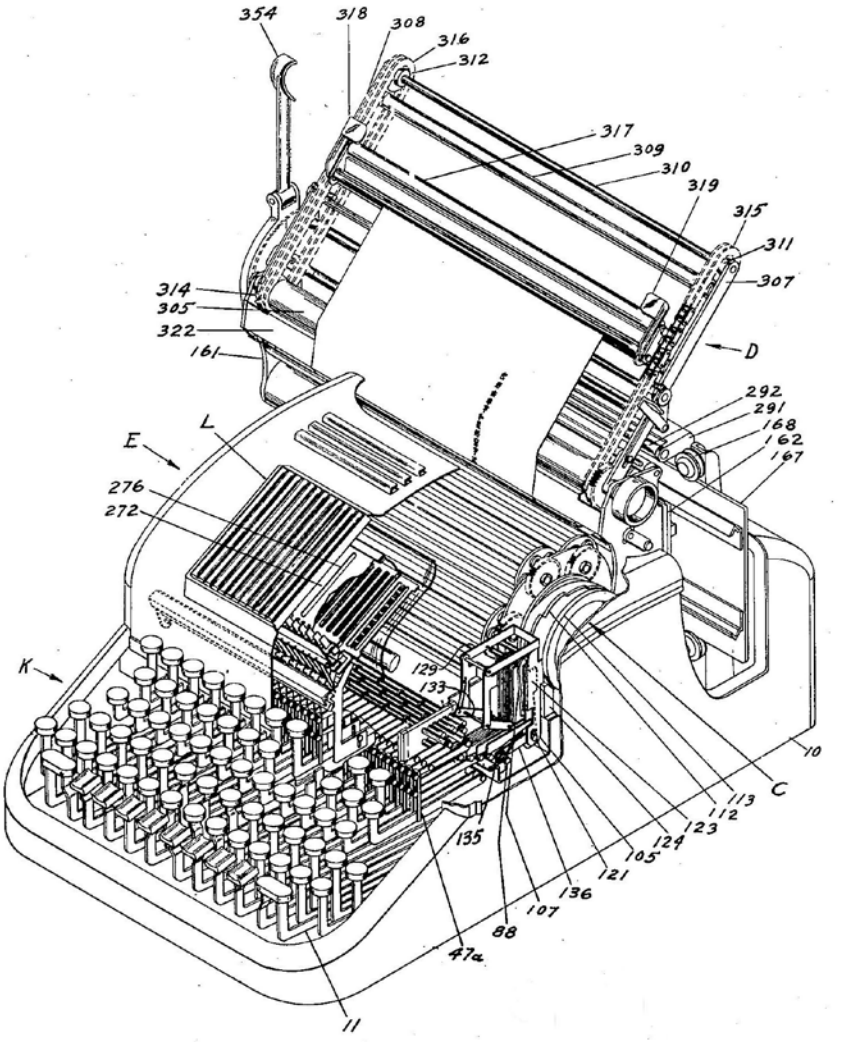

FIGURE 7 *"Chinese Typewriter"* (*US Patent 2613975, approved October 14, 1952*).

instrumental in persuading Lin to return to the United States in 1936. Their friendship did not survive the typewriter. To finance his typewriter, Lin exhausted nearly all the royalties from his English-language best sellers.[40] The 14- by 19-inch apparatus almost bankrupted Lin, and he tried to borrow money from Buck. She refused, and this reputedly precipitated their much publicized falling out. Against the odds, Lin's patent was finally approved in October 1952.

40 Lin 1994, 250–257.

By the mid-twentieth century, efforts to modernize the Chinese language were well under way. The new forms of its institutionalization, however, were far from uniform. Lin's typewriter played an important role in this process toward standardization and dissemination on an international scale. Though not the first Chinese-language typewriter, Lin's machine contributed greatly to the eventual digital globalization of the Chinese ideograph.[41] Details of his model served as a main reference in subsequent developments in electronic writing: multilingual electric typewriters, Chinese-language input in data processing, the encoding of Chinese characters into unique numerical codes for storage and transmission, and electronic software programs that use a phonetic version of Chinese.

All this was indebted to Lin's early interest in linguistics and phonology, which later took a back seat to his literary career.[42] Already twenty-three years before he filed the application at the US Patent Office in New York, Lin was developing important views on the history and taxonomy schemes of the Chinese language. After studying for a year at Harvard with Irving Babbitt and Bliss Perry and then earning a doctorate in historical phonology from Leipzig, he returned to Beijing in 1923 at the behest of Hu Shi, who offered him a professorship in linguistics and literature in the Department of English at Beijing University. Lin was a core member of the Committee for Research on the Romanized Spelling of the National Language that was appointed by the Ministry of Education in 1925. He strongly supported the use of the alphabet in Gwoyeu Romatzyh (National Romanization), a Mandarin Romanization system developed by the linguist Zhao Yuanren.[43] Debates about modern lan-

41 Lin made reference to three other Chinese-language typewriters in his patent application alone: "Type-writing Machine" (US Patent 1,247,585), by Pan Francis Shah of Tianjing, China, in 1916; "Apparatus for Writing Chinese" (US Patent 1,260,753), by Heuen Chi of New York in 1915; and "Chinese Language Typewriter and the Like" (US Patent 2,412,777), by Chung-Chin Kao of New York in 1943. Unlike other Chinese typewriters, which required typists to fill in the characters manually and memorization of characters, Lin's machine boasted a "self-evident" keyboard that required no training. See "New Typewriter Conquers Chinese Symbols," *Popular Science* 151 (November 1947): 137. One of the earliest Chinese-language typewriters was designed by the Protestant missionary Devello Z. Sheffield of the American Board mission. See Sheffield 1897.

42 Yet Lin acknowledged that his investment in the fate of the Chinese script remained a lifelong interest. His writings on the topic are collected in a volume separate from his other works. See Lin 1967.

43 DeFrancis 1950. For the history of and contemporary developments in Romanization in China, see the very useful website "Romanization Systems," www.pinyin.info/index.html (last accessed September 14, 2009).

guage reform reached new heights, stirring up controversies and oppositions that called for no less than a full-scale "Han script revolution" (*Hanzi gaige* 汉字改革).

Taking a more conciliatory approach, however, Lin advocated taking the best of both worlds.[44] Simplifying character strokes and developing a Romanization system for the Chinese language, Lin assured, were not mutually exclusive projects. It was necessary to pursue a parallel course. Lin thought it redundant to devise a new system of acoustic symbols when the alphabet had already proven its phonetic usefulness in the different Indo-European national languages. He reviewed other possibilities that were important in the discussions among European linguists and philologists on the correspondence between alphabetic notations and their symbolized sounds in the science of phonetics.

Otto Jespersen's Analphabetic System (later renamed antalphabetic) was one such "ultra-alphabetic" system. It used "half-mathematical" formulae to symbolize not sounds but elements of sounds and the positions of the various articulatory components of the speaking organ.[45] Lin thought the system, though devised with the precision of scientific transcription, bore no intuitive relation to everyday use. Alexander Melville Bell's Visible Speech, a second alternative, was similarly too intellectually detailed for the average language user. Bell wished to devise a system that would include all language sounds, from foreign to dialectal, as well as inarticulate sounds like sneezing and yawning, all by using iconic symbols that through their shape would indicate how the sounds were formed. Its classification of consonants and vowels was arbitrary and often disputed, undercutting its efficacy as a "Universal Alphabet." Neither did Lin find a simple shorthand system based on speed and accuracy—like Pittman's or Boyd's—entirely desirable. A common script, for Lin, needed to be not only clear and easy to use but also aesthetically pleasing. Only one scheme was agreeable to him. Henry Sweet's "organic alphabet" (derived from Bell's Visible Speech but replacing Bell's iconic symbols with Roman-

44 DeFrancis 1950. For the history of and contemporary developments in Romanization in China, see the very useful website "Romanization Systems," www.pinyin.info/index.html (last accessed September 14, 2009).

45 Jespersen 1889, 8–12. The technical precision with which Jespersen dissected the location and movement of sound made his system too abstruse even for the learned, and even more inappropriate for the audience Lin had in mind. Henry Sweet describes analphabetic type as "a group of symbols resembling a chemical formula, each symbol representing not a sound, but an element of a sound: the part of the palate, tongue, etc., where the sound is formed, the degree of separation (openness) of the organs of speech, and so on." As quoted in Henderson 1971, 255.

FIGURE 8 *The cover of a special issue of National Language Monthly* (*Guoyu yuekan* 国语月刊) (*August 1922*) *that features key essays and debates over the national language reform. Soldiers* (*center*), *wielding weapons of the phonetic alphabet, slaughter a horde of traditional Chinese characters in the ancient seal-script style* (*bottom right*), *while the masses coolly watch and stand united behind a row of Roman letters that spell out "Latin script" in Gwoyeu Romatzyh* (*middle left*).

alphabet-based notations) fitted his vision of a practical approach using the existing alphabetic system.

After careful study, Lin came up with his own solution in 1924. The breakthrough later became the cornerstone of the indexical system for his typewriter. Lin wanted to design a system that any user could "pick up without learning" (*bu xue er neng* 不学而能).[46] He proposed looking up any given character in a dictionary first by looking up the "top stroke" (*shoubi* 首笔) in the character's radical, or root, component.[47] The top stroke was further categorized into one of five stroke movements—straight across, straight down, down to the side, point, and hook—listed in the dictionary in that order. With the second stroke, the same order is repeated, thus narrowing the range of possible characters.

The idea was to classify the character according to its most identifiable component and then to index the character in a new order of progression. A complementary method was developed with reference to the "final stroke" (*mobi* 末笔). The exit stroke is generally the longest and thus most easily made out at the bottom portion of the character. The combined method, Lin boasted, was also greatly superior to those that came before, the majority of which depended on rhyme and vowels. "Reverse-cut" (*fanqie* 反切), for example, a method used in classical phonology since the late second century, indicates the pronunciation of one character by combining the opening consonant and closing vowel of two other characters. The cumbersome method, however, could not account for changes that took place in oral speech over the centuries. Even if one cuts correctly, the result may be far removed from its original pronunciation. As a lexicographical tool, the reverse-cut method ensures little inherent logic and systematization. In contrast, a system based on obvious top and bottom strokes, Lin noted, is "entirely based on shape and does not at all borrow from analytical methods, which are in any case not the strong suit of the Chinese."[48]

Lin's method, however, incorporated a more important mechanism. Although based on the graphic shape of the Chinese character, his system assimilated an alphabetic logic. The process of elimination by repetition of the five stroke types in fact had an augmenting effect. Lin likened it to the classifying order of aa, ab, ac, ad, and so on. Cai Yuanpei notes that Lin uses "the example of the alphabet and applies it to the strokes of the Chinese script," thereby

46 Lin 1967, 284.

47 Lin 1967, 273–274.

48 Lin 1967, 284.

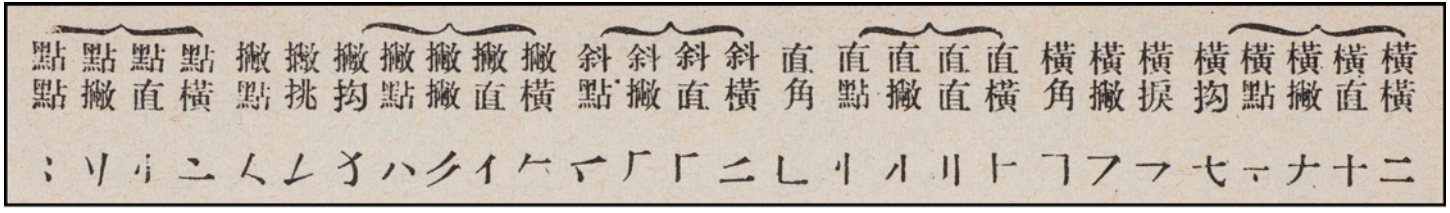

FIGURE 9 *Lin Yutang's "top stroke," or first stroke, is categorized according to five stroke types: (1) straight across, or horizontal (heng 橫); (2) straight down, or vertical (zhi 直); (3) down to the side, or slanted (pie 撇); (4) point (dian 点); and (5) hook (gou 拘). After the first stroke is identified in this way, the process repeats with the second stroke, and so on. Lin likens it to the linear logic of alphabetism: aa, ab, ac, ad, etc.* (LIN 1994, 273–74).

producing a veritable alphabetism of "aba, abb, abc, etc."[49] Taking on the alphabetic property of linear extension, the new method of assembling Chinese characters treated stroke order like the serial arrangement of the alphabet. Instead of a cluster of simple graphemic units, the ideograph was now conceptualized differently, linear rather than strictly combinatory. In short, Lin made it possible to "spell out" the Chinese character. Under this new configuration, the kind of cultural and philosophical difference that McLuhan and others saw in the ideograph would no longer be located on the level of visible arrangement. Instead, this cultural difference was converted into a new communicability between the ideograph and the alphabet. This transposition transformed the grammaticality—rather than the plain physical form—of the phonetic alphabet into the mechanization of the Chinese written language.

What had long distinguished the phonetic alphabet from the ideograph—combined syllabary, phonetic divisions, linearity—dissolved within a double frame of stroke and alphabetic index.[50] Lin's method shifted the frame of reference such that alphabetism could no longer be posed as the ideograph's lack. The idea that the ideograph is not phonetic or linear, nor the alphabetic pictorial and sensorial, one might recall, was never tenable or philologically sound. Yet Lin took the demystification a step further by reabsorbing that difference into the new classification system of the ideograph. By figuring out a new mode of accommodating and assimilating alphabetic languages, Lin fused what he thought were the best features of both languages. Behind the escalation of language wars between English and Chinese, a different kind of mutual governance came into play. Lin's pragmatic support of using the alphabet for Romanization, on the one hand, and innovative appropriation of its distinctive features to re-index the Chinese character, on the other, nullified the antagonism with strategic accommodation.

With this in mind, one can better appreciate Lin's design. The keyboard to Lin's typewriter displays not alphabetic letters but Chinese character radicals, separated and ordered in precisely the way he had outlined above. It has seventy-two keys, thirty-six of which represent the different top (upper left-hand) components, while the remaining twenty-eight represent the bottom (lower right-hand) components. When a top key and a bottom key are pressed simultaneously, the type roller matches the two together and prints a unit of eight

49 Cai Yuanpei wrote the preface to "Hanzi suoyinzi shuoming." See "Cai Jiemin xiansheng xu" (Preface by Mr. Cai Jiemin), in Lin 1967, 276–77.

50 Scholars now agree that the Chinese script is an imprecise syllabary that has both visual and semantic qualities. See Daniels and Bright 1996, 189–208. See also I. J. Gelb 1963, 85–88, 166–189.

possible combinations. An accompanying novel device is the method of displaying the qualifying characters. After the first round of selection, which is based on a match by radicals, a "magic eye," or projected window, appears above the keyboard. It allows the typist to see a maximum of eight characters displayed in a row. The typist then presses a key from another group of eight keys, each corresponding to a particular character in the viewer that is then finally printed on the paper.[51] With "reference to the shape or design of the strokes making up the character at the top and the bottom of the character," the machine can also be adjusted to transcribe other languages: "the same structure, but with modified key symbols and type arrangements, may be used to print other languages which are based upon the English alphabet and still other languages in which alphabets are not used."[52] Lin can truly be said to have developed an unprecedented Chinese writing machine that established a new logical parsing system of the ideograph, enabling its further use with other languages.

The convergence between mechanization and translation marked a new era for the ideograph and unexpectedly propelled the globalization of the Chinese script in a new direction. On May 18, 1948, Mergenthaler Linotype Company signed a contract to test Lin's prototype for a period of two years in order to evaluate its feasibility for mass distribution. The overhead cost, however, in manufacturing each typewriter and its customized parts was too high (about $1,000 each). In September 1951, Lin officially sold Mergenthaler the copyright for $25,000. At this point, the US Air Force embarked on a research project on "automatic translation," later known as machine translation. After multiple inquiries, the US Air Force concluded that they needed to use Lin's indexical keyboard as the prototype for their research on the Chinese language and gave it to the International Business Machines Corporation (IBM) for further development. Beginning in 1960, the IBM Research Center pursued the study, sponsoring projects conducted at various American universities. In summer 1963, IBM unveiled the "Sinowriter," which was jointly developed with the Mergenthaler Linotype Company. Gilbert W. King, the director of research at the center, led the project. With reference to a concurrent project on Russian-English

51 For a description of this process, see "New Typewriter Conquers Chinese Symbols," *Popular Science* 151 (November 1947): 137. Lin's magic window may be considered the prototype for the computer display of characters that share the same pinyin forms in contemporary Chinese-language software. As pinyin does not designate tones, all qualifying homophones are displayed in a rectangular window, which the user has to scroll through to identify the appropriate character.

52 Lin 1952a 3, 25.

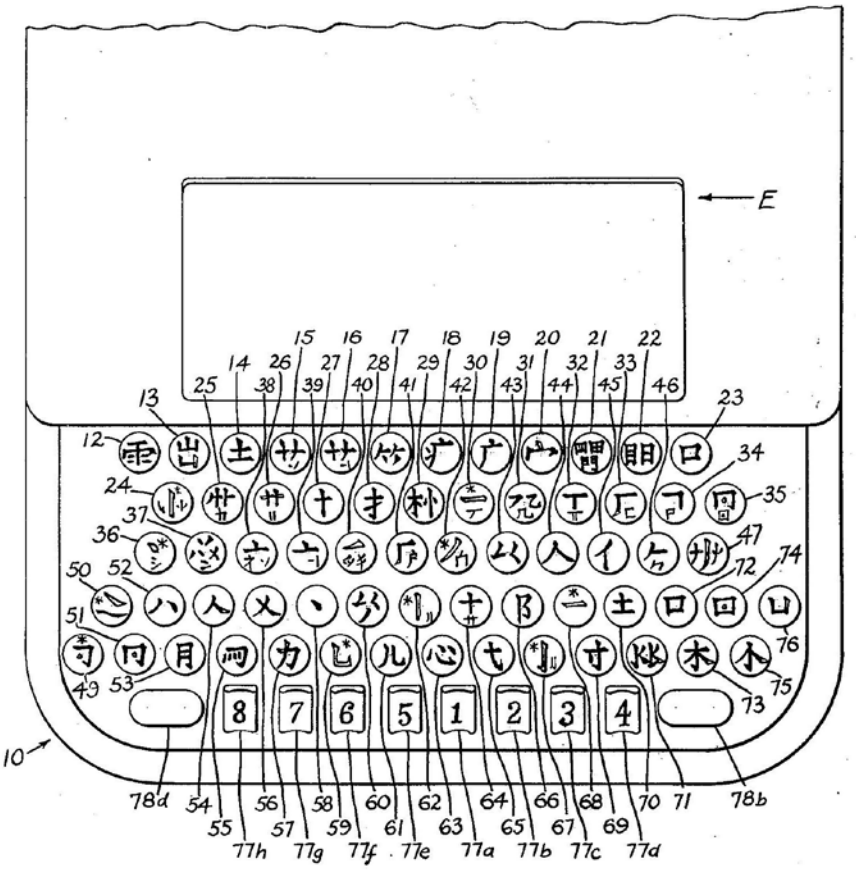

FIGURE 10 *The keyboard for Lin Yutang's "Minkuai" (*"*clear and quick*"*) Chinese-Language Typewriter can generate up to ninety thousand characters from seventy-two keys (thirty-six top strokes, twenty-eight bottom strokes).*

machine translation, headed by Austrian Sinologist Erwin Reifler at the University of Washington in Seattle, King and his collaborators introduced the Sinowriter keyboard in a 1963 issue of *Scientific American*.[53]

Unlike its predecessor, Sinowriter was cost-efficient and put broad dissemination within reach. The news was picked up quickly by, among others, the *Armed Forces International Journal*, "almost an official organ of the armed

53 King and Chang 1963.

forces":[54] "The Sinowriter is an inexpensive machine which can be operated by typists who are not familiar with the Chinese language. After two weeks of training, a typist can obtain a speed of 40 characters per minute, or the equivalent of about 40 words a minute in English."[55] In designing the Sinowriter, King and his associates had developed a device for photographic storage and optical information retrieval that greatly improved upon the memory capacity for the number of characters in Lin's typewriter. The original search for "a keyboard that could be learned fairly quickly by people who are not necessarily able to read Chinese"[56] had led them to Lin's keyboard in the first place. Lin's "geometric-recognition scheme" provided a crucial missing piece.[57] Building on Lin's specific character index and display system, King's contribution, as he explained in a patent application in 1965, was to encode the Chinese input as punched holes on a Flexowriter tape, a conversion into binary codes that facilitates a faster storage and retrieval process.

Lin's upper and lower components, with the pressing of corresponding keys, could compose up to 90,000 characters based on a blueprint of 9,000 (he based the figure on the Chinese telegraph codebook). King's optical retrieval system, with the help of punched tape, called up and displayed the qualifying characters in "less than 100 milliseconds."[58] In terms of what a given operator had to do, the task was identical to Lin's prescribed steps: "the operator actuates a key having the desired upper segment configuration to thereby insert a binary X address code into an X address register and then actuates a key having the desired lower segment character configuration to thereby insert a binary Y address code into a Y address code register. These thereafter control the character plate having both the selected upper and lower character segments to be positioned within the retrieval area, which in turn enables the qualifying characters to be optically projected at a viewing area."[59] In effect, King explains, "the two keys activate a mechanism that projects onto a screen the whole family of characters sharing these particular configurations. The family may contain only one member or as many as sixteen. Each member of the family is numbered from one to sixteen, and the operator can easily identify the one that matches the desired character in the Chinese text."[60] This further paved

54 "Military Paper Willed to Club: Army, Navy Journal Worth Half Million," *Pittsburgh Press*, March 19, 1949, 17.

55 "X," *Armed Forces International Journal* 102 (1964): 15.

56 King and Chang 1963, 129.

57 King and Chang 1963, 130.

58 King et al. 1967, 3.

59 King et al. 1967, 2.

60 King et al. 1967, 2.

the way for Chinese-language machine translation, as the characters now "may be easily and quickly converted to a system for encoding and printing complex characters in a second language."[61]

King did not stop there and was about to take the project further. In 1962, he accepted a position at Itek Corporation, an important manufacturer of reconnaissance technology and a US defense contractor during the Cold War, and expanded research was undertaken both there and at IBM. In 1964, Itek came out with their own Modified Sinowriter, also known as Chicoder (Chinese Encoder). According to its public release statement in November 1966, it was capable of encoding 10,500 characters.[62] The method could be used for anything that required machine processing of large quantities of Chinese characters.

In retrospect, the impact of Lin's typewriter on the era of machine translation gave an unexpected twist to the original intent of machine translation. A historic memorandum by mathematician Warren Weaver on July 15, 1949 is credited with first launching machine translation as a scientific enterprise. Weaver, who was the director of the Natural Sciences Division of the Rockefeller Foundation and widely influential among major policy makers in US government agencies, was convinced that the success of cryptography during World War II had much more to say about the "frequencies of letters, letter combinations, intervals between letters and letter combinations, letter patterns, etc. *which are to some significant degree independent of the language used*" [emphasis in original].[63] His collaboration with Claude Shannon in pioneering the first introduction to information theory further convinced him to attempt a universal code for translating languages into one another.

Ironically, what helped to fulfill Weaver's vision was not the decipherment of a Chinese-coded English, or Basic English, but Lin's alphabetically coded Chinese. Insofar as machine translation involved the Chinese language as part of its universalizing project, the modern Chinese language reform met it halfway in its own quest for global mediality. Machine translation mechanized the cipher effect that was already in play when Lin embedded the alphabetic logic in the Chinese script. The process was well under way with China's late nineteenth-century script reform. Each system's race for its own distinction made possible, paradoxically, a new meeting ground. As the ideograph later joined the alphabet, the alphabet was also converted into one possible technological

61 King and Chang 1963, 130.

62 Eng 1966.

63 Weaver 1955, 16.

function of the ideograph.[64] As both orders of writing pursued their own visions of universal utility, their mutual material conversion formalized an implicit, shared desire to bring all languages under one roof—with one major difference. The alphabetic-ideographic conversion happened neither for the sake of common ancestry (a theory pursued by eighteenth- and nineteenth-century European linguistics under the sway of evolutionary theory) nor for the dream of a single lingua franca (in service of one nation's dominance over others during the era of Europe's self-ordained civilizing mission). What fundamentally changed in the twentieth century, if the Chinese script revolution has made its global mark, is how technological accommodation and practical hospitality came to define the true arena for the exercise, extension, and dissemination of world linguistic power.

Bibliography

Boltz, William 2000. "Logic, Language, and Grammar in Early China," *Journal of the American Oriental Society* 120, 2: 218–229.

Cai Xiyong 1956 [1896]. *Chuanyin kuaizi* [Phonetic quick script]. Beijing: Wenzi gaige chubanshe.

Cai Zhang 1934. *Zhongguo sujixue* [Chinese shorthand]. Shanghai: Zhonghua shuju.

Castells, Manual 1996. *The Rise of the Network Society: Information Age*. Cambridge, MA: Blackwell.

Chen Qiu 1958 [1903]. *Xinzi Ouwen qiyin duo* [Seven-tone new script of Europe]. Beijing: Wenzi gaige chubanshe.

Cheng, W. K. 2001. "Enlightenment and Unity: Language Reformism in Late Qing China," *Modern Asian Studies* 2: 469–493.

Daniels, Peter T., and William Bright, eds. 1996. *The World's Writing Systems.* Oxford: Oxford University Press.

DeFrancis, John 1950. *Nationalism and Language Reform in China*. Princeton, NJ: Princeton University Press.

____ 1984. *The Chinese Language: Fact and Fantasy.* Honolulu: University of Hawai'i Press.

64 Interestingly, watching how his Chinese-index typewriter had transformed into the Modified Sinowriter, Lin did not seem to recognize the momentousness of his intervention. He was, in the end, awed by the photocomposition and retrieval system, like the one King designed based on his Mingkuai typewriter, which leaves the human operator jobless in the ever-refining technologization of mechanical printing.

____ 1989. *Visible Speech: The Diverse Oneness of Writing Systems.* Honolulu: University of Hawai'i Press.

Dennis, James Shepard 1906. *Christian Missions and Social Progress: A Sociological Study of Foreign Missions.* 3 vols. New York: Fleming H. Revell.

Downey, Gregory J. 2008. *Closed Captioning: Subtitling, Stenography, and the Digital Convergence of Text with Television.* Baltimore, MD: Johns Hopkins University Press.

Elman, Benjamin A. 2005. *On Their Own Terms: Science in China 1550–1900.* Cambridge, MA: Harvard University Press.

____ 2007. "New Directions in the History of Modern Science in China: Global Science and Comparative History," *Isis* 98: 517–523.

Eng, Albert 1966. "Experimental Modified Sinowriter (Chicoder)." Itek Corporation (November).

Fan, Fa-ti 2007. "Redrawing the Map: Science in Twentieth-Century China," *Isis* 98: 524–538.

Fenellosa, Ernest 2008. *The Chinese Written Character as a Medium for Poetry*, edited by Haun Saussy et al. New York: Fordham University Press.

Gelb, I. J. 1963. *A Study of Writing.* Rev. ed. Chicago: University of Chicago Press.

Gitelman, Lisa 1999. *Scripts, Grooves, and Writing Machines: Representing Technology in the Edison Era.* Stanford, CA: Stanford University Press.

Gordon-Cumming, Constance F. 1898. *The Inventor of the Numeral-Type for China, by the Use of Which Illiterate Chinese Both Blind and Sighted Can Very Quickly Be Taught to Read and Write Fluently.* London: Downing.

Guo Yanli 1998. *Zhongguo jindai fanyi wenxue gailun* [Introduction to translated literature in modern China]. Hankou: Hubei jiaoyu chubanshe.

Havelock, Eric 1987. "Chinese Characters and the Greek Alphabet," *Sino-Platonic Papers* 5: 1–4.

Henderson, Eugénie J. A., ed. 1971. *The Indispensable Foundation: A Selection of the Writings of Henry Sweet.* London: Oxford University Press.

Hu, Danian 2007. "The Reception of Relativity in China," *Isis* 98: 539–557.

Huters, Theodore 2005. *Bringing the World Home: Appropriating the West in Late Qing and Early Republican China*. Honolulu: University of Hawai'i Press.

Jespersen, Otto 1889. *The Articulation of Speech Sounds Represented by Means of Analphabetic Symbols.* Marburg: N. L. Elwert.

Kaske, Elizabeth 2008. *The Politics of Language in Chinese Education 1895–1919*. Leiden: E. J. Brill.

King, Gilbert W., and Hsien-Wu Chang 1963. "Machine Translation of Chinese," *Scientific American* 208: 124–135.

King, Gilbert W., et al. 1967. "Character Printer." US Patent 3,330,191 (July 11).

Kreilkamp, Ivan 2005. "Speech on Paper: Charles Dickens, Victorian Phonography, and the Reform of Writing," in Leah Price and Pamela Thurschwell, eds., *Literary Secretaries / Secretarial Culture.* Aldershot, Hants, UK: Ashgate 13–31.

Kurtz, Joachim 2011. *The Discovery of Chinese Logic*. Leiden: E. J. Brill.

Lackner, Michael, Iwo Amelung, and Joachim Kurtz 2001. *New Terms for New Ideas: Western Knowledge and Lexical Change in Late Imperial China*. Leiden: E. J. Brill.

Lewis, Mark E. 1999. *Writing and Authority in Early China.* Albany: State University of New York Press.

Li, Jiesan 1956 [1896]. *Minqiang kuaizi* [Script for the Min Topolect]. Beijing: Wenzi gaige chubanshe.

Lin Yutang 1946. "Invention of a Chinese-Typewriter," *Asia and the Americas* 46: 58–61.

____ 1952a. "Chinese Typewriter." US Patent 2,613,795 (October 14).

____ 1952b. "Visual Selecting Device for Chinese Typewriters and the Like." US Patent 2,613,794 (October 14).

____ 1967. *Yuyan xue luncong* [Collection of philological essays]. Taibei: Wenxing shudian.

____ 1994. *Lin Yutang zizhuan* [Autobiography of Lin Yutang]. Beijing: Zhongguo huaqiao chubanshe.

Liu, Lydia H. 2004. *The Clash of Empires: The Invention of China in Modern World Making*. Cambridge, MA: Harvard University Press.

Liu Mengyang 1957 [1908]. *Zhongguo yinbiaozi shu* [Chinese phonetically indexed script]. Beijing: Wenzi gaige chubanshe.

Lloyd, Geoffrey, and Nathan Sivin 2002. *The Way and the Word: Science and Medicine in Early China and Greece*. New Haven, CT: Yale University Press.

Lu Zhuangzhang 1956 [1892]. *Yimu liaoran chujie: Zhongguo qieyin xinzi Xia qiang* [A primer at a glance: Chinese new phonetic script in the Amoy dialect]. Beijing: Wenzi gaige chubanshe.

Lu Tiande 2000. "Zhonghua shouchuang yinzi zhi yuanzu Lu Zhuangzhang xiansheng" [Mr. Lu Zhuangzhang: The original pioneer in creating a phonetic script in China], reprinted in Xu Chang'an, ed., *Yuwen xiandaihua xianqu* [Pioneers in language modernization]. Xiamen: Xiamen shi yuyan wenzi gongzuo weiyuanhui bangongshi 76–80.

Luo Changpei 1934. *Guoyin zimu yanjinshi* [A history of the development of the national tonal alphabet]. Shanghai: Shangwu tushuguan.

Mair, Victor H. 2000. "Advocates of Script Reform," in William Theodore de Bary and Richard Lufrano, eds., *Sources of Chinese Tradition.* 2nd ed. 2 vols. New York: Columbia University Press, vol. 2, 302–307.

McLuhan, Marshall, and Harley Parker 1968. *Through the Vanishing Point: Space in Poetry and Painting*. New York: Harper & Row.

Mok Lai Chi 1893. "An Adaptation of Phonography to the Chinese Language in the Cantonese Dialect," *Phonetic Journal*, July 29.

Needham, Joseph 1956. *Science and Civilisation in China: History of Scientific Thought*. Cambridge: Cambridge University Press.

Needham, Joseph, and Christoph Harbsmeier 1998. *Science and Civilisation in China: Language and Logic*. Vol. 1. Cambridge: Cambridge University Press.

Ni Haishu 1948. *Zhongguo pinyin wenzi yundong shi jianbian* [A short edition of the history of China's phonetic script movement]. Shanghai: Shidai shubao.

Pollard, David 1998. *Translation and Creation: Readings of Western Literature in Early Modern China 1840–1918*. Philadelphia: J. Benjamins.

Qian Xuantong 1999. "Suigan lu" [Random notes], in *Qian Xuantong quanji*. 6 vols. Beijing: Zhongguo renmin daxue chubanshe, vol. 2, 1.

Ramsey, S. Robert 1987. *The Languages of China*. Princeton, NJ: Princeton University Press.

Schmalzer, Sigrid 2007. "On the Appropriate Use of Rose-Colored Glasses: Reflections on Science in Socialist China," *Isis* 98: 571–583.

Shapiro, Hugh 2000. "Neurasthenia and the Assimilation of Nerves into China," paper presented at "Symposium on the History of Disease," Academia Sinica, Institute of History and Philology, Nankang, Taiwan, June 16–18.

Sheffield, Devello Zelotos 1897. *The Chinese Type-Writer, Its Practicality and Value*. Paris: Imprimerie nationale.

Shen, Grace 2007. "Murky Waters: Thoughts on Desire, Utility, and the 'Sea of Modern Science,'" *Isis* 98: 584–596.

Sivin, Nathan 1982. "Why the Scientific Revolution Did Not Take Place in China—or Didn't It?" *Chinese Science* 5: 45–66.

Tsu, Jing 2005. *Failure, Nationalism, and Literature: The Making of Modern Chinese Identity 1895–1937*. Stanford, CA: Stanford University Press.

___ 2010. *Sound and Script in Chinese Diaspora*. Cambridge, MA: Harvard University Press.

Van der Loon, Piet 1992. *The Classical Theater and Art Song of South Fukien: A Study of Three Ming Anthologies.* Taibei: SMC Publishing.

Wang Bingyao 1956 [1896]. *Pinyin zipu* [Table for phonetic script]. Beijing: Wenzi gaige chubanshe.

Wang Hui 2004. *Xiandai Zhongguo sixiang de xingqi* [The rise of modern Chinese thought]. 4 vols. Beijing: Sanlian.

Wang Zhao 1903. *Chongkan guanhua hesheng zimu xuli ji guanxi lunshuo* [Reedition of the Mandarin combined tonal alphabet and an exposition of its principles and relations]. Beijing: Biaobei hutong yishu cangban.

Wang, Zuoyue 2007. "Science and the State in Modern China," *Isis* 98: 558–570.

Weaver, Warren 1955. "Translation," in William N. Locke and A. Donald Booth, eds., *Machine Translation of Languages: Fourteen Essays*. Cambridge, MA: Technology Press of MIT; New York: Wiley 15–23.

Webb, John 1669. "An Historical Essay Endeavoring a Probability that the Language of the Empire of china is the Primitive Language." London: Printed for Nath. Brook.

Wilkins, John 1668. *An Essay Towards a Real Character, and a Philosophical Language.* London: Printed for S. Gellibrand [etc.].

Xiong Yuezhi 2011. *Xixue dongjian yu wan Qing shehui* [The dissemination of Western learning and late Qing society]. Beijing: Zhongguo renmin daxue chubanshe.