The Double Pigeon Chinese Typewriter

February 2020

Mingxin DENG, Yan ZHANG, William Chin Fung NG, Yinxin YI, Nan HE

I. Preface

Elisabeth Kaske

The Double Pigeon Typewriter produced in Shanghai in 1977 has come to Leipzig through the intervention of Philip Clart, professor for the history and culture of China at Leipzig University, who remembered to have seen a Chinese typewriter during his years as a student at Bonn University. Prof. Clart called up his colleague, Prof. Ralph Kauz, who personally brought the machine to Leipzig in August 2019. At this time, I was just designing my seminar "National Language Movements in China and Asia" and I decided to devote parts of the seminar to an introduction into language technologies, especially to the development of the Chinese typewriter. I was fortunate to have found an enthusiastic group of students who were passionate about finding out what the typewriter was about. The publication of Mullaney's book *The Chinese Typewriter* in 2018 has greatly aided our task. It was fascinating to find out how short-lived language technologies can be. While the European feather and the Chinese brush were used for two thousand years, the Chinese typewriter did not make it beyond some seventy years. And while the European typewriter survives in the form of the QWERTY keyboard, now also standard in China, the Chinese typewriter is a historical artifact. Our great hope to find someone in Germany who still has used it was Prof. Monika Motsch, emerita from Bonn University, whose Chinese grammar was typed on this very machine. She wrote, however: "Allerdings habe ich selbst nie an der Maschine gearbeitet, das haben wohl die Hilfskräfte gemacht, ich habe höchstens mal bewundernd zugeschaut, ohne wirklich in deren Geheimnisse einzudringen." (The truth is that I have never worked on this machine myself. That was done by the student assistants. I only watched in admiration, without really penetrating its secrets). This handbook is the result of our own exploration. It provides an introduction to the technical challenges posed by the Chinese characters, a short summary of the history of the typewriter, and an introduction to its use. In the appendix, you find a poem written by William Chin Fung Ng on the Double Pigeon Typewriter. The Numbers mark the position of the character on the basic tray bed grit of the typewriter and back-up boxes for additional characters.

II. Chinese Characters and the Typewriter

Mingxin DENG

It was once common sense that Chinese characters are not conducive to China's absorption and dissemination of modern ideology and technology, due to the difficulty of finding Chinese characters in dictionaries, navigating library catalogs and retrieving names or demographic information. However, since the nineteenth century scholars and technicians have developed a series of Chinese linguistic technologies such as indexes, lists, catalogs, dictionaries, braille, telegraphy, stenography, typesetting, typewriting and computing. These efforts have allowed

the Sinosphere to keep up with cutting-edge knowledge without abolishing Chinese characters.

1. What are Chinese Characters?

Chinese characters have always been considered "hard to recognize, hard to remember, and hard to write" because of their unique and complex glyphs. So, what exactly are Chinese characters? Why are they so difficult? The structure of Chinese characters is completely different from an alphabetic script. Chinese characters consist of "strokes", each a single continuous motion of the pen in the shape of a dot, a line, or a hook. In order to find a Chinese character in a dictionary, one needs to know the number of strokes and the standardized order in which they are written. However, the strokes themselves are not characters and do not convey any meaning.

The most basic meaningful Chinese characters consist of simple strokes and are either pictographs, for example "木 mù (tree)" represents the picture of a tree, or ideographs, for example "言 yán (speech)" represents words coming out of a mouth (below). However, only 3% of all characters are such purely semantic characters, 97% are semantic-phonetic. The semantic part is called a "radical". In the example of our typewriter (section IV), the two vertical columns from left to right all have "言 yán (speech)" as radical on the left, therefore they all have something to do with speaking. The difficulty is that, first, the radical is not always on the left side of the character (they may appear on the top or bottom as "見 jiàn (see)" in the third column from the right). Secondly, the pronunciation of the phonetic part is historic and corresponds to contemporary language only in 24.2% of cases. Third, the meaning may also have shifted from its original semantic origin. This makes learning difficult. There are also many Chinese characters.

2. How to Find Chinese Characters?

A system of 214 radicals used to ease character retrieval in dictionaries first appeared in the late Ming Dynasty (1368–1644) and was used in the Kangxi Dictionary compiled by Emperor Kangxi in the Qing Dynasty (1644– 1911). In this dictionary, more than 40,000 Chinese characters are first divided into 214 categories according to their semantic radicals. The first radical of the 214 radicals in the Kangxi Dictionary is written with one stroke (一, the number one), the last with seventeen strokes (龠, flute). Under each radical classification, characters are sorted according to the number of residual strokes.

Alternative indexing systems for dictionaries were invented in the nineteenth and twentieth centuries. Phonetic indexing is now common overseas, where learners of Chinese are used to alphabetic scripts. In Russia, the method of retrieving Chinese characters by the last stroke was also widely used because of its relative simplicity (Oshanin 1983). In China, stroke indexing systems mainly located Chinese characters by the total number of strokes or the first stroke. In the 1920s, Wang Yunwu invented the Four-Corner Method which encodes the shapes in the four corners of Chinese characters (Wang 1928). Lin Yutang split Chinese characters into upper and lower parts as the basis for retrieval in his Mingkwai ("Clear and Quick") Chinese-language typewriter (see below). These attempts to make tens of thousands of Chinese characters easy to find have affected the construction and use of Chinese typewriters to varying degrees.

3. What is a Chinese Typewriter?

Now, what is a Chinese typewriter? How can a typewriter deal with so many Chinese characters? Two methods have been tried to limit the number of characters, the combinatorial and the common usage method. The first method tries to dissect the Chinese characters into their modular parts, the 214 radicals and a limited number of residual parts, and then to rebuild the character in the typing process. However, this method has not been favored by the Chinese, because the results are not in line with Chinese aesthetics. All Chinese typewriters that were ever mass-produced opted for the common usage method, which limited the number of characters to between 2,500 and 6,000 characters that were actually used in contemporary writing. The first inventor of a Chinese typewriter in 1897, the American missionary DevelIo Z. Sheffield, identified 4,662 characters in common use and subdivided them further into four categories: "very common", "common", "less common" and "untabulated". Subsequent typewriters reduced the number of characters even further, partly due to language reforms that made the contemporary colloquial language into the standard instead of the classical language used in Sheffield's time for most written purposes. However, modern typewriters still had to deal with c. 2,500 characters. Therefore, the Chinese typewriter should be imagined more as a movable desk-top type-setting machine and printing press than as a typewriter in the usual sense.

III. A Brief History of the Chinese Typewriter

William NG, Yan ZHANG

Three main types of machines emerged in the history of Chinese typewriters: a common usage, a combinatorial, and an alternative typewriter which combines techniques from the former two designs.

The common usage typewriter can be traced back to the 1897 invention by DevelIo Z. Sheffield. Later in 1916, the Chinese aerospace engineer Zhou Houkun 周厚坤 invented another common usage model, which fits 4,700 frequently-used characters on a revolving cylinder. These models, though never mass-produced, became the ancestors of the modern typewriter. The second major type of the Chinese typewriter was a combinatorial machine, which makes use of the characteristic of Chinese characters that they could be split into smaller parts. In 1915, Qi Xuan 祁暄, a Chinese student in the USA, combined Zhou Houkun's cylinder with a combinatorial system of more than 1,000 "pieces", radicals and residual parts of Chinese characters, to assemble less common characters piece by piece. This model enabled the production of more varied characters. However, the combinatorial method failed to achieve the orthographic aesthetics of complex Chinese characters and the typing speed was very slow. Thus, Qi Xuan's prototype did not survive.

Dedicated to perfect Chinese printing technology, the publisher Commercial Press began to be actively involved in developing a Chinese typewriter. After dismissing Zhou Houkun's common usage design of a cylinder with fixed characters, Commercial Press instead adopted a design by another engineer, Shu Zhendong 舒震東, which used about 2,500 movable Chinese characters arranged in a flat square case (the tray bed). Additional characters were housed in a separate box and could be fitted into the slugs of the main tray bed if needed. The machine saved time and produced more legible characters. Most importantly, it could be used in concert with carbon-infused paper to produce multiple copies of a single

document. In the 1920s, Commercial Press launched a promotional campaign for the *Shu-style Chinese typewriter* 舒式華文打字機, making Shu's machine the first mass-produced Chinese-language typewriter in history and established the prototype of all subsequent Chinese typewriters.

Taking advantage of the ongoing Japanese imperialist expansion in China in the 1930s, the Japan-based Nippon Typewriter Company launched the Bannō, Wanneng, or "All-Purpose" typewriter 萬能型打字機 in 1940. Advertised as the "Japanese, Manchu, Chinese, Mongolian All-Script Typewriter", the Wanneng typewriter was available for sale in all major cities in China and soon dominated the market. As a result, Chinese manufacturers suffered severe losses. In terms of design, the Wanneng typewriter also used a collection of movable types similar to the Shu-style Chinese typewriter, but featured a character-retrieving rod accompanied by a finding aid.

The 1940s witnessed the development of another important typewriting invention. In 1947, the well-known linguist, translator, and novelist Lin Yutang 林語堂 debuted his MingKwai Chinese typewriter 明快中文打字機 in the USA. Lin's machine combines both the common usage and combinatorial methods. It consists of a series of eight-sided, rotatable metal bars, with Chinese characters and radicals engraved upon each of their surfaces, boasting more than three times the capacity of the tray bed on a common usage typewriter. Besides, instead of "typing" characters, the operator is actually "inputting" numbers for character strokes, whereupon a viewfinder called "Magic Eye" will present a choice of candidates, allowing the operator to choose the required character. Although the MingKwai eventually failed to be launched onto the global market due to financial troubles, Lin's innovation has significantly influenced computer input methods until today.

After the Second World War, Chinese typewriter manufacturers regained control of the domestic market, but continued to produce copies of the Japanese-designed Wanneng model. As part of the economic exchange program between socialist countries, the East German company Optima was asked to redesign the Wanneng typewriter. The company produced a Chinese typewriter between 1952 and 1955 (Lippmann 2010). Eventually, a conglomerate of nationalized typewriter factories in Shanghai created the Double Pigeon Chinese typewriter 雙鴿牌中文打字機. Still based on the design and structure of the Wanneng, but removing the character-retrieving rod and finding aid, Chinese manufacturers officially presented the Double Pigeon typewriter in 1964 after years of testing, making it the iconic movable-type Chinese typewriter in post-1949 China, until the age of the computer obliterated mechanical typewriters for good.

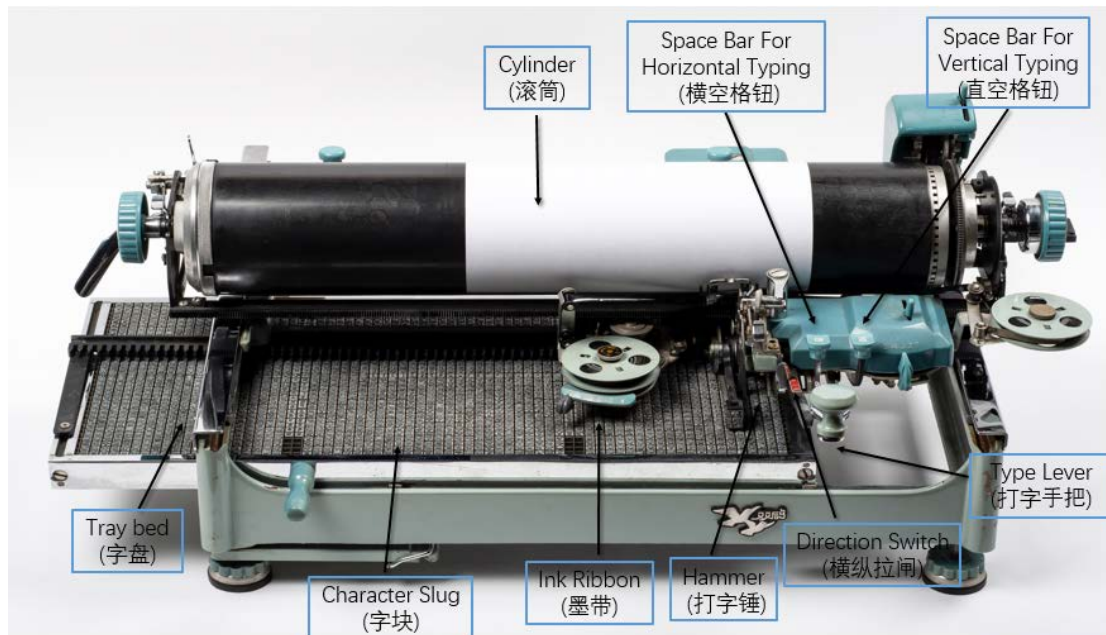# IV. The Double Pigeon Chinese Typewriter

Xinyi YIN, Nan HE

Image: Emma Harrison, „The Double Pigeon Chinese Typewriter", The British Library, zugegriffen 5. Februar 2020, https://www.bl.uk/history-of-writing/articles/the-double-pigeon-chinese-typewriter.

1. Structure - Name & Function of Different Parts

The Double Pigeon Chinese typewriter became iconic in Maoist China (1949–76). Its design reflects almost a century of experimentation to create a typewriter that could accommodate the thousands of characters used in written Chinese. It consists of a customizable tray bed of almost 2,450 loose pieces of character slugs that are picked up and struck against the ink ribbon by pushing down a hammer using the type lever.

The Double Pigeon Chinese typewriter has nine main parts as follows:
Cylinder: the place to put and locate paper and it will roll automatically while typing
Tray bed: a drawer containing 2,450 character slugs.
Character slug: a metallic slug, which has a protruding character to print on the paper.
Ink ribbon: an expendable module serving the function of transferring ink to paper in various devices for impact printing.
Hammer: a selector tool, which pinches the character slug and put it against the ink ribbon to print characters on the paper.
Type Lever: handle to control and locate the hammer with the hand.
Space bar for horizontal typing: serves two functions. The first is to leave a space while typing from left to right. The second is to change to the next line while typing from top to the bottom (like the "shift" in keyboard)
Space bar for vertical typing: also serves two functions.The first is to leave a space while typing from top to the bottom. The second is to change to the next line while typing from left to right (like the "shift" in keyboard)

Direction Switch (the red one): to decide to type vertically or horizontally.

2. Tray bed characteristics

How to find a character in a 2,450-character tray bed? In the standard tray bed, Chinese characters are arranged in a matrix, which concurrently follows three orders of taxonomy: common usage, radicals, number of strokes.

(1) Standard Index of the Double Pigeon Chinese Typewriter

1st order: Characters are first arranged by *common usage.* According to the frequency of usage, frequently-used characters are put in the center of the tray bed, less frequently used characters are located on both sides.
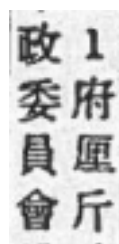

Pic 1   Pic 2

2nd order: In each part, characters are further sorted according to the *radical-stroke system* according to the traditional orthography. For example, , 講 "to speak", 議 "to discuss" are put in the same vertical line.

3rd order: Characters under the same radical are further sorted by *residual stroke numbers*. In reality, because the characters can be easily removed from their slug, each typist will customize his or her tray bed to the particular needs of work. Many Chinese words are formed by two or more characters. Words can be put together by the *radiation method*, i.e. characters that frequently form words together can be placed close to each other, for example 說話 "to speak" and 談話 "to talk" 講話 "to deliver a speech" in Pic 1) After 1950s, some frequently-used *politic terms* are put together, like 政府 "government"', 委員會 "committee" in Pic 2)

(2) Special Index of this machine

This Chinese Typewriter was used at Bonn University and customized by Prof. Monika Motsch and her student assistants. They rearranged all the characters according to their pronunciation, like 哥 (gē, brother)，歌 (gē, song) were put in the same horizontal line. All characters are listed from A to Z vertically.
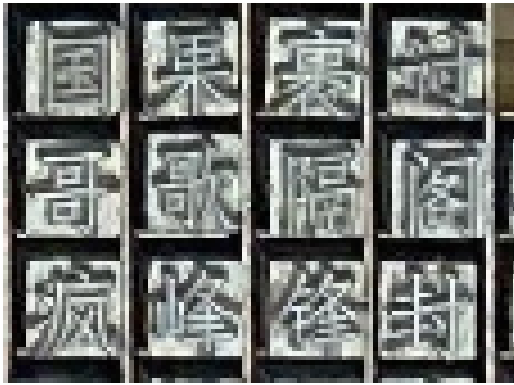
guó guǒ guǒ guò
国   果   裹   过
gē   gē   gé   gé
哥   歌   隔   阁
fēng fēng fēng fēng
疯   峰   锋   封

3. Typing

Typists need to follow these steps to type a text:
1. Install the paper onto the cylinder.
2. Decide the direction of typing: use the direction switch for horizontal typing or vertical typing.
3. Select the character by pulling the typing lever.
4. Align the hammer with the desired character, then depress the typing lever to type.

4. Training of typist:

Chinese typewriting encompassed its own distinct physical regimen, in terms of the demands it placed on memory, vision, hands, and wrists. For example, typewriting handbooks instruct the typist: to hold the typing lever with index finger, middle finger and thumb; use mainly wrist force to depress the tying lever; attach the character slug to the hammer gently and depress the tying lever with even force. Attaching and depressing should be continuous and coherent (Yang 1985).

Blind typing, such as on the alphabetic typewriter, was not possible for the Chinese typewriter. The typists were required to rely heavily on their faculty of vision. That's why the Chinese typewriting needed special training in order to learn the "cartography" of the tray bed. This was done, first, by a set of repetitive drills of typing common Chinese terms (two-character compounds) and names. Second, the Chinese typists were trained to develop a sensitivity to the next character even before typing the first desired character. Furthermore, trained typists had to constantly vary the force with which they typed heavier and lighter characters, in direct correspondence to the stroke count, so as to maintain a consistency across the text, and to avoid puncturing the paper (Mullaney 2017: chap. 4).

V. References

British Library. 2016. "The Double Pigeon Chinese typewriter". <https://www.bl.uk/history-of-writing/articles/the-double-pigeon-chinese-typewriter> (10.12.2019).
Lippmann, Eberhard. 2010. AEG - Olympia - Optima: Büromaschinen aus Erfurt 1924-2004. Sutton.

Mullaney, Thomas S. 2012. "The Moveable Typewriter: How Chinese Typists Developed Predictive Text during the Height of Maoism." Technology and Culture Volume 53 (Number 4): 777–814.

Mullaney, Thomas S. 2017. "The Chinese Typewriter: A History". Cambridge, MA/London: The MIT Press.

Mullaney, Thomas S. 2018. The Chinese Typewriter: A History. MIT Press.

Mullaney, Thomas. 2012. "The Moveable Typewriter: How Chinese Typists Developed Predictive Text during the Height of Maoism". *Technology and Culture*, 53/4, 777–814.

Oshanin, I. M, ed.. Bol'shoj kitajsko-russkij clovar' 華俄大辭典. Moskva: Izdatel'stvo „Nauka", 1983.

Wang, Yün-wu. Wong's System for Arranging Chinese Characters: The Revised Four-Corner Numeral System. Shanghai: The Commercial, 1928.

Yang Yueting 杨月亭.1985. Zhongwen daziji de gouzao, shiyong yu weixiu *中文打字机的构造,使用与维修*, 32-33. Shanghai kexue jishu chubanshe 上海科学技术出版社.

Zhang Yushu 張玉書, and Ling Shaoqian 凌紹雯, eds. Kangxi Zidian 康熙字典. Harvard University Digitized Edition. 北京: 內府刻本, 1717, https://iiif.lib.harvard.edu/manifests/view/drs:17752267$1i.

VI. Poem by William Chin Fung Ng

(The Numbers mark the position of the character on the basic tray bed grit of the typewriter and back-up boxes for additional characters.)

上海雙鴿牌中文打字機
57-23, 48-9, 20-25, 39-8, 50-20, 62-34, 4-28, 5-5, 45-35, 25-11
The Shanghai Double Pigeon Chinese Typewriter

(上平聲四支韻)
(57-23, 22-21, 14-24, 35-6, 30-34, 16-33)
(Written in the *zhi* (fourth) rhyme of the upper-level tone)

伍展楓
22-28, 52-33, 備 1: 37-25
William Ng Chin Fung

辦公記錄最相宜，
34-1, 59-8, 53-11, 19-16, 60-35, 15-29, 30-31
Most suitable for handling office work and recording,

出版書文不費時。
23-4, 33-1, 67-24, 4-28, 53-2, 30-7, 30-24
it is also not time-consuming to use the Shanghai Double Pigeon Chinese Typewriter for publishing or writing texts.

莫以龐形譏舊物，
52-19, 36-31, 59-20, 64-29, 22-11, 46-13, 26-28
Never disregard the Typewriter for its bulkiness,

曾稱佳製煥新姿。

18-3, 60-3, 60-11, 50-34, 備 1: 21-39, 57-29, 38-35

it was once praised for its high quality, aglow with new radiance.

精心幸得良才護，

21-13, 58-29, 70-29, 46-5, 47-15, 62-2, 31-10

Fortunately, this well-designed Typewriter is now being looked after by some outstanding talents,

逸史能傳百世知。

38-31, 38-23, 14-20, 34-4, 35-13, 45-24, 32-34

and its hidden history could then be passed down through generation after generation.

握素懷鉛雙鴿在，

10-28, 53-25, 43-10, 70-21, 20-25, 39-8, 22-33

Once you grasp a sheet of paper, carry the lead types, and have the Double Pigeon Typewriter with you,

端身揿打即成詩。

32-6, 3-24, 備 1: 24-14, 5-5, 41-11, 62-3, 22-24

by sitting upright and pressing down the typing lever, you could then compose a poem.

2020 年 1 月於德國萊比錫

35-30, 35-32, 35-30, 35-32, 20-20, 35-31, 5-33, 38-32, 45-5, 40-9, 備 1: 3-53, 1-2, 34-28

January 2020 in Leipzig, Germany