# Typesetting Chinese: A personal perspective

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## Introduction

First of all, I would like to thank TUG for inviting me to speak at the TUG 2005 conference. This is the first time ever that a TUG conference has been held in China — where typesetting was first invented. As a Chinese citizen, I welcome all of you who traveled such a long way to participate in the conference and to visit my country.

My talk will begin with a very brief survey of the development of printing in China since the invention of movable types in the 11th century. A proper account of this development can easily fill several volumes; therefore, given our limited time, I will show only a few interesting examples, which are selected quite arbitrarily. Hopefully, they will still provide us some insights into certain conventions in typesetting Chinese books that still influence current practice.

Then, I will compare briefly the page layout and available fonts between European typesetting and Chinese typesetting in the 20th century.

Lastly, from a personal perspective, I will talk about the challenge that high-quality professional typesetting systems such as TEX and its friends face when typesetting Chinese.

## A brief history of movable type printing in China

The invention of movable types in China was in the period of 1041 to 1048 by a common man named *Bi Sheng*. He himself did not leave any documented evidence of his invention. The earliest record of movable type was written by *Shen Kuo* in his book *Dream Pool Jotting*. Figure 1 shows the page that describes how to make clay movable types.

Since then, a variety of different materials have been used to make movable types, including copper, tin, lead, wood, clay and porcelain. After *Bi Sheng*'s work, the next most significant development of movable types was by *Wang Zhen*. He surveyed the various techniques of making movable types using clay and tin types in his book *A Treatise of Agriculture*. In the same book, he described a new technique for



**Figure 1**: A page of *Dream Pool Jotting* by Shen Kuo, the earliest record of making movable types.

typesetting Chinese with a detailed drawing. This employed a revolving table for arranging the types by a rhyming scheme, which was believed to be invented by the book's author. A model of this revolving table is shown in Figure 2.

While movable type printing was used and developed continually throughout the centuries since its invention, it has never dominated the printing industry in China, at least not until the beginning of the twentieth century. The technique of wood block printing has been perhaps more popular than movable type printing throughout history. This is because:

- The intrinsic complexity of the Chinese language. There are thousands to tens of thousands of different characters.
- The difficulty and expense of producing such a large number of types.
- The relatively low demand for books, making movable type printing less advantageous than wood block printing.

Table 1 shows a timeline summarizing the historical development of printing in China.

Table 1: Historical Development of Chinese printing: a brief timeline

| | | |
|---|---|---|
| 1600–1066 BC | | writing brush and ink |
| 403–221 BC | | earliest existing brush |
| 206BC–220 AD | | ink made from pine soot |
| 105 AD | Cai Lun | improved papermaking technique |
| 636 AD | | woodblock printing |
| 1041–1048 | Bi Sheng | invented movable-type printing with clay type (recorded by Shen Kuo) |
| 1297 | Wang Zhen | improved movable-type printing with wooden and metal (tin alloy) type |
| 1455 | Gutenberg | metal movable-type printing |
| 1660s | Mueller | wooden Chinese type (3824 pieces) |
| 1812–1822 | Morrison | tin alloy type, 200,000 pieces of 20,000 different characters; printed a six-volume dictionary in Macao |
| 1859–1861 | Cole | a complete set of types in seven different sizes, Shanghai |
| 1915 | | old-style type commissioned by the Commercial Press (two sizes) |
| 1927–1934 | | Fong Song style type made |



**Figure 2**: A model of Wang Zhen's revolving table for typesetting



**Figure 3**: A rolled-up strip of writing on bamboo

## Bookbinding

The oldest books in Chinese were written on strips made of wood or bamboo. They were then tied and rolled up using strings, as illustrated in Figure 3. Because of these long thin strips, when paper was invented, followed by the subsequent invention of printing, the Chinese still kept their writing direction vertical.

Bookbinding developed from scroll rollers, to pleated leaf binding, to wrapped-back binding, to thread binding. The vertical direction was preserved through a thousand years of history. Only in the mid-twentieth century did the horizontal direction begin to dominate in most of China. Even today, most books of literature published in Taiwan and Hong Kong are in the vertical direction.

## Influence from the west

Starting in the 19th century, trading and exchange in many other fields between China and the west increased dramatically. Probably the most important influence on modern printing in China came from a Christian missionary named Robert Morrison. He arrived in Macao in 1807. Later he set up a printing press and published a 6-volume dictionary of the Chinese language in 1815. For this project, he made 200,000 pieces of type of 20,000 different characters.

Unfortunately, these type pieces were destroyed in 1856 in a riot.

The first half of the 19th century saw many westerners coming to China. Another influential person in Chinese printing history from that time is an American named Cole, who initially set up a printing press in Macao. The press was moved to Ningpo and later to Shanghai in 1860. He set up a type foundry in Ningpo, and produced type pieces in seven different sizes.

## Page layout

It is interesting to compare the typical page layout of western and Chinese books. Although there are numerous variations, traditional European book designers lay out a typical page with the top margin smaller than the bottom margin and the inner margin smaller than the outer margin, as shown in Figure 4a.

In contrast, Chinese tradition puts the emphasis on the opposite side. The top margin is larger than the bottom margin and the inner margin is larger than the outer margin, as shown in Figure 4b. This ratio has been developed from far back in history, when text was printed vertically on one side only, and the pages were folded back and bound using stitches.

## Measurement of types

Throughout their long history of printing with movable type, the Chinese did not develop a common system for type measurement. Each type maker made type pieces in their own sizes. It was not until the mid-nineteenth century, when modern movable types and printing presses were introduced from the west, that a common system of type sizes was developed. This system initially had 7 different sizes, numbered sequentially.

Table 2 lists the type size numbers and their equivalent point size. This numbering system was widely adopted and used until the very recent times when digital typesetting replaced traditional metal types.
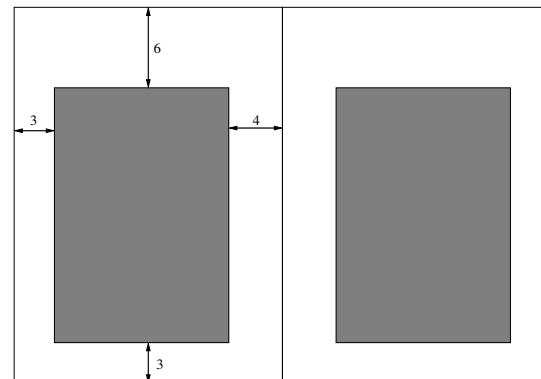
Table 2: Numbering system for Chinese type sizes

| # | #1 | #2 | #3 | #4 | #5 | #6 | #7 |
|---|---|---|---|---|---|---|---|
| pt | 28 | 21 | 16 | 14 | 10.5 | 8 | 5.25 |

Another widely used system of type measurement is the K system. It was introduced together with phototypesetters from Japan. 1K is equal to 0.25 mm, and commonly used sizes are between 8K
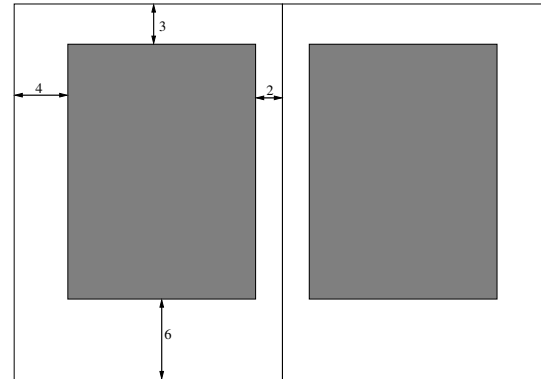


**a.** Traditional European books



**b.** Traditional Chinese books

**Figure 4**: Comparison of page layout

and 40K. Since the widespread adoption of digital typesetting, the point system has become dominant.

## Available fonts

Creating fonts is a complicated and expensive undertaking. Song and Kai are the names of the two main families, with their roots in wood block printing. They were the only font styles for a very long time in the history of movable type printing. Other font families have been developed only recently: Fong Song style was created in 1916. With the introduction of phototypesetters from Japan, available Chinese font families started to increase. However, there are still many fewer Chinese fonts than western fonts.

It is not uncommon to commission typefaces for a book in western languages. In contrast, it is extremely rare for a Chinese printing press or publisher to commission a font for a book. Although with the advance of digital typesetting more fonts are now available, many new fonts lack many characters, often even common characters, let alone the complete repertoire of CJK characters in Unicode.

黄鶴知何去　剩有遊人處

黃鶴知何去　剩有遊人處

黃鶴**知何去**　**剩有**遊**人**處

黃鶴知何去　剩有遊人處

黃鶴知何去　剩有遊人處

**Figure 5**: Some common font styles: Song, Kai, Old Song, Hei and Fong Song (from top to bottom)

For example, the Old Song style shown in the middle row of Figure 5 lacks four of the ten sample characters. They therefore have to be substituted by other styles, which is hardly acceptable in professional publishing.

## Opportunities and challenges

The current situation in Chinese typesetting is that the era of hot metal has passed away. Digital technology is used but it is dominated by a very small number of imported commercial software applications. Home-grown software has quite a small portion of the market. The demand for high quality typesetting software is high.

On the other hand, open source and free software like TEX and its friends is available, but localization effort is required. As has been described above, localization does not only mean being able to handle Chinese characters. It is necessary to cater to the cultural differences as well. What Chinese users need is integrated solutions. TEX and its friends provides a flexible foundation. Good solutions can be built on top of this foundation. The challenge is to bridge the gap between these existing technologies and the specific requirements of Chinese typesetting.