

## TRANSITIONS AND USAGE OF SAWS IN THE EURASIAN CONTINENT: THE COMPARATIVE HISTORY OF THE DEVELOPMENT OF TECHNIQUES AND TOOLS TO CREATE WOODEN ARCHITECTURE

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### 1. Introduction

Tools for creating architecture that takes wood as its primary material (wooden architecture) originate with the axe.

This applies to both the eastern and the western parts of the Eurasian continent. It is presumed that the stone axe, composed of a stone tool attached to a wooden shaft, was used from the era of chipped stone tools (the Paleolithic age) when stones were chipped with other stones to create a blade. Entering the era of ground stone tools when blades were created by grinding a stone with another stone (the Neolithic age, the Jomon era in Japan), the performance of tools increased dramatically, and it is presumed that the stone chisel also began to be used around this time. It is believed that the two primary tools for creating wooden architecture in this period were the stone axe and the stone chisel.

From around 5,000 years ago, tools made of metal such as copper, bronze, and iron began to be used, adding the saw and the plane to the set of primary tools used for creating wooden architecture. The axe was mainly used for logging and lumbering, the saw and the chisel for working on the joints of construction members, and the plane for finishing the surface of construction members.

Comparing the development of those primary tools in the Eastern and Western parts of the Eurasian continent, the axe and the chisel have followed similar transitions.<sup>1</sup>

Both in the east and the west, by about 3,000 years ago when tools began to be produced with bronze, three different sizes of saws were used, from large, to middle and small. According to the bronze saws that have been discovered so far, we can discern a tendency of saws in the west being designed for pulling-use and those in the east for both pulling and pushing-use. It is believed that pushing-use became predominant both in the east and the west when tools began to be produced with iron (about 2,000 years ago).<sup>2</sup>

The plane with a wood or metal body began to be used in the west around 2,000 years ago, but the spearheaded plane continued to be used for a long time in the east. It is presumed that the plane with a wood or metal body began to be used around 800 years ago (Yuan and Ming dynasties). The plane with a wood or metal body was designed for pushing-use both in the east and the west.<sup>3</sup>

However, both the saw and the plane with a wooden base were designed for pulling-use in Japan, an island located at the Eastern edge of the Eurasian continent. Why could this be, and are there no other regions that use the tools by pulling?

Below are the findings of a research regarding these questions.

## 2. Technologies and saws for making wooden architecture

### 2.1 Usage of saws

In Japan, pulling-saws were introduced around the 15th century, and the one-man operated wide-blade rip saw replaced the two-man large-sized saw as the most common saw for lumbering from the mid-16th century onwards.

In china, it is presumed that iron saws began to be used by pushing around 3rd century B.C. (Han dynasty) and its usage has continued to the present day.

In Europe too, iron saws began to be used pushing around the 3rd century B.C. (Roman era), and its usage has continued to the present day.

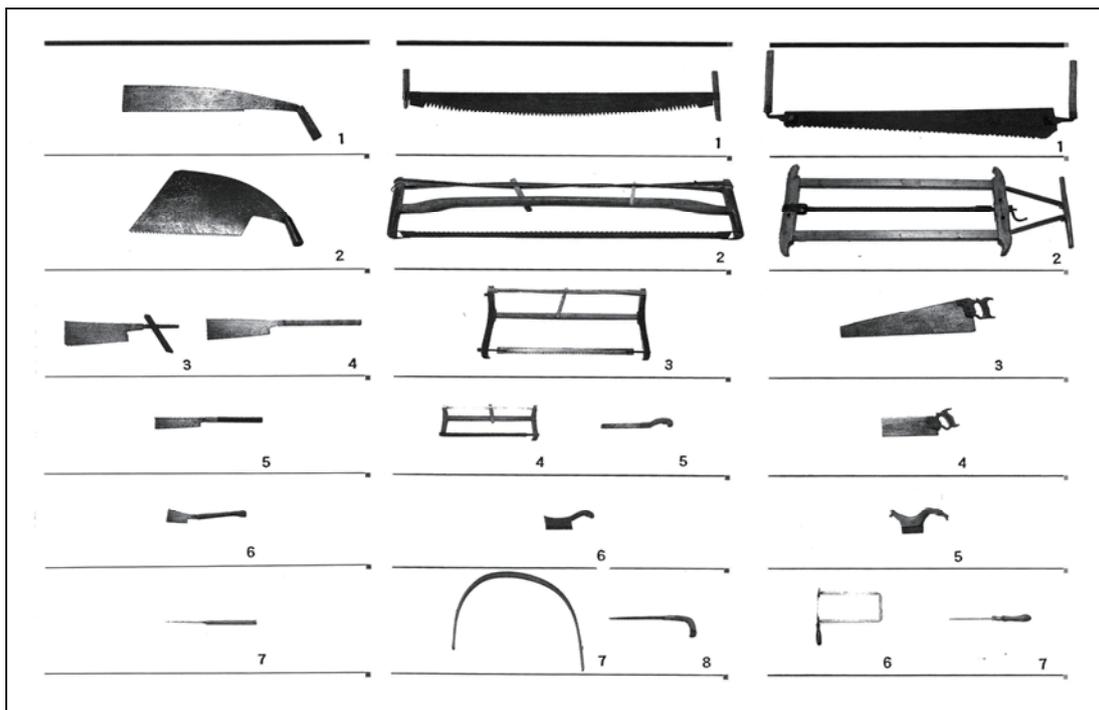


Fig. 1: Usage of saws

### 2.2. Technology for making wooden architecture

In Japan, around the 15th century when there was a transition from the lumbering method employing splitting (split lumber) to a method employing saws (ripped lumber), wide and thin boards as well as square timber with accurate cross-sectional surfaces began to be used as members for constructing wooden architecture. As a result, craftsmen were required to finish the joints of those members in an increasingly sophisticated manner, and due also to the

advancements in blacksmith technology, the performance of saws improved. The thinner the blade is, the more smooth the surface and the higher the accuracy of the joints. We can presume that due to these factors, pulling-use, which allows for more subtle control over the saw, became widespread.

On the other hand, pushing-use in China and Europe is a method suited for processing hard architectural members. Hard wood requires the saw to be used not just with the strength of the arms but that of the entire body too. Thus the blade needs to be thick, as a thin blade would easily break when used in such a manner. A thick blade creates a rough cross-sectional surface and lowers the accuracy of joints. The architectural philosophy that it was not a problem to have gaps in the joints may have allowed pushing-use to continue to be prevalent in China and in Europe.

### 2.3 The geographical distribution of different saw usages

In the 19th century, when wooden architecture was still created using traditional hand tools, pushing-use was prevalent in Europe and China, while pulling-use was prevalent in Japan. How, then, are saws used in those regions that connect the eastern and western parts of the Eurasian continent? According to research literature, pulling-use was prevalent in Turkey, and other countries dominated by Turkey during the Ottoman rule such as Greece and Bulgaria, Iraq, Iran, Afghanistan, Northern India, Nepal and Bhutan.<sup>4</sup>

Looking at the distribution of forests in the Eurasian continent, coniferous trees can be observed in those regions where pulling-use is predominant. These are, in other words, regions where coniferous trees which are softer in comparison to the hard broadleaf trees (such as oak trees) are used for creating construction members. Regions with coniferous forests are connected in belt form from Turkey to Japan.<sup>5</sup> We shall call this the “pulling-use belt”.

The Guizhou and Yunnan provinces of southern China are also located within this belt but many of the residents are ethnic minorities such as the Dong. Among such people too, saws designed for pulling-use are used although only partially.<sup>6</sup>

### 3. Conclusion

In the Eurasian continent, saws are used by pushing in Europe and China, and by pulling in the coniferous tree belt from Turkey to Japan. The primary reasons for this difference are the hardness of timber and the required accuracy of processing for construction members. Pulling-use was observed in those areas where soft wood (coniferous trees) was processed with high degrees of accuracy.

### Addendum

When did saws begin to be used by pulling in the different regions in the coniferous tree belt? In Japan, it is believed that this happened around the 15th century, but this remains unclear for other countries such as Turkey and should be the subject of further research. Moreover, although this article suggests that the difference in usage originates in the hardness of the wood and the required accuracy of the processing, another factor that may be related is the working posture, which was predominantly sitting in many of the regions in the coniferous

trees belt. We hope that detailed research in each region will be carried out as joint research in the future.

## Notes

1. See the reference [1] and [2].
2. See the reference [3].
3. See the reference [4].
4. See the reference [9].
5. See the reference [10].
6. See the reference [11] and [12].

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