User Interface Design for a Mokkan Reading Support System

Yasutaka TONE1, Akihito KITADAI2, Masato ISHIKAWA2, Masaki NAKAGAWA2, Hajime BABA3 and Akihiro WATANABE3

1Department of Computer and Information Sciences, Tokyo University of Agriculture and Technology, Japan. archaea_tone@hands.ei.tuat.ac.jp
2Tokyo University of Agriculture and Technology,
3National Research Institute for Cultural Properties, Nara

Abstract. This paper describes user interfaces of a system for helping archeologists decode mokkans. A mokkan is a wooden tablet excavated from ruins in Japan. Decoding mokkans is important to study the history, but they are damaged and stained with handwritten characters badly degraded. Therefore, it is very difficult even for expert archeologists. The system for helping them has three components of image processing, character recognition and information retrieval. The image data processing makes mokkan images easy to read. The character recognition presents characters candidates from unclear mokkan images. The information retrieval provides candidates of place names. In this paper, we present two types of User Interfaces for this system. One is a multi-window interface and another is a tiling-window interface. The former has higher flexibility. Archeologists can position and expand windows freely as they like. The latter has less flexibility, i.e., being unable to change windows like the former, but does not bother archaeologists to operate them. As the result of an evaluation experiment by archeologists, both the interfaces obtained high evaluation, however, the latter was basically preferred in respect of ease of use and ease of understanding with some exceptions. This paper also presents a display method of multiple candidates of decoding.

1. Introduction

A ’mokkan’ is a wooden tablet on which text was written by brush in India ink. Mokkans were widely used in Japan at the Nara era (A.D. 710 – 794). The total number of mokkans excavated in Japanese ruins is about 320,000 pieces, and 170,000 pieces or more of them are excavated from the ruins of the Heijokyo palace site in Nara. Decoding mokkans is very important to know lifestyle, flow of materials, relations among regions, condition of economy and so on of that time. However, excavated mokkans are damaged, stained and sometimes broken into pieces so that character images are rarely kept completely. It is difficult for even expert archeologists to read mokkans. Mokkans already decoded remain at the order of ten thousand. The number of undecided mokkans is increasing owing to excavations while the number of experts is deceasing. Therefore, we proposed a system to help archeologists decode mokkans. This system employs image processing, character recognition and information retrieval as shown in Kitadai et al., 2005.

We think it is necessary to give easy-to-use User Interface for the archeologists so that they may effectively utilize these functions. Especially, we think it is important to reduce time and effort required for operation without sacrificing the archeologists’ intuitions. We propose two types of GUI - multi-window interface and tiling-window interface for this system.

Section 2 describes mokkans in some detail and problems in decoding them. Section 3 presents our system. Section 4 describes two types of GUIs for this system. Section 5 presents evaluation and result.

2. Details and Problems in Decoding Mokkans

To read scripts on a mokkan, archaeologists extract ink from the mokkan or its picture first. However, very often, ink has been blurred, damaged or missing because:

1. Color of ink has been faded out or decolored.
2. Color boundaries between ink area and the background (skin of wood with grain) have been vague since the surfaces of wooden tablets have become dark and stained.
3. Some parts of a mokkan containing ink have been broken and lost.

For these reasons, the archeologists have to make conjectures or hypotheses on the lacked ink parts.

The archeologists had been using commercial image processing software for decoding when needed. For example, they have been used “©Adobe Photoshop”. However, this makes decoding work interleaved and disturbed. Powerful image processing suitable for mokkans must be incorporated into the support system.

Another problem with decoding mokkans is that the archaeologists have to consult many dictionaries and books on character patterns, place names, people names so on as shown in Figure 2. They are also interruptive for them. The support system should help them consult appropriate information without interrupting their thinking.

Yet another problem is that the archeologists draw pictures to decode a mokkan as shown Figure 3. Drawing and writing is part of decoding so that the support system should provide pen interfaces.
3. Support System for Decoding Mokkans
The support system gives three functions – image processing, character recognition, and information retrieval – to the archaelogists as shown in Figure 4 where IP, CR and IR denote Image Processing Library, Character Recognition Engine and Information Retrieval Module, respectively.

Image processing makes unclear mokkan character images clear as much as possible. Character recognition gives the candidates of recognition result a mokkan character image. Information retrieval reduces chores for retrieval.

4. Proposal of GUIs for the Support System
We need to provide the GUI which makes three functions cooperate effectively. We propose two different types of GUIs, a multi-window type shown in Figure 5 and a tiling-window type interface shown in Figure 6. The former has higher flexibility. Archaeologists can position and expand windows freely as they like. The latter has less flexibility, i.e., being unable to change windows like the former, but they are not bothered by window operations. We think that archaeologists may need a system which is easier to understand, even if, it sacrifices the flexibility. Some archaeologists don’t like operations of a computer. We prepared a function that users can change layout of tiles freely, but it was not mounted at this time. It is because we wanted to make a difference if possible between the two interfaces. Instead of providing this function, we designed the best layout of tiling windows from our walkthrough prototyping so that the archaeologists can use the system easily. At the center of system area, they can see the tile of a mokkan image, and areas of other functions are surrounding the center area as shown in Figure 6.
Figure 4: Concept of system.

Figure 5: The screen shot of the system with multi-window interface.

Figure 6: The screen shot of the system with tiling-window interface.
5. Result of Evaluation
We asked four archeologists to test both the interfaces. As a result, both the interfaces were basically appreciated. As we expected, however, they expressed the opinion that the multi-window interface was annoying. On the other hand, each archeologist had his/her own favorite layout of the tiling windows. The function should be mounted so that the layout of tiles can be edited freely.

As for the functions, the archeologists appreciated all the three functions, especially, information retrieval.

6. Conclusion
We proposed two GUIs for the support system to help archeologists decode *mokkans*. The system has three components of image processing, character recognition and information retrieval. Two types of User Interfaces is either a multi-window interface or a tiling-window interface. The latter has less flexibility but the archeologists showed their preference to the latter since they were not bothered by window operations. On the other hand, each archeologist had his/her own favorite layout of the tiling windows so that the layout of tiles should be changeable freely.

We are planning to avail our system to 30 researchers on *mokkans* with the interface proposed in this paper. Then we will evaluate this system and these interfaces.

At this moment, the system is being used at the desktop environment, but it must be usable where *mokkans* are excavated. Moreover, archeologists have been using pen and paper for decoding. They draw pictures of *mokkans* and write down ideas and hypotheses. Therefore, we are interested in preparing the system on pen-based computers and provide pen-based interfaces.

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