# The Development of a self-learning system of Braille reading and writing for visually impaired people and sighted people

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Abstract: The development of a self-learning system of Braille reading and writing for both visually impaired people and sighted people is described. This system consists of a reading sub-system and writing sub-system, and in the reading sub-system, a learner can study the rules and read the presentation of Braille codes separately. In the writing sub-system, a learner types Braille codes into a computer through an external ten-key box mapped to 6 points of a Braille code. In this paper, the detailed explanation of the system and the result data are shown. Since it has been developed very recently, we don't have enough data now, but the result data shows the effectiveness of this system.

Key Words: Self-learning System, Visually Impaired People, Body-Braille

## 1. Introduction

Since the Braille system was invented by Louis Braille in 1825, it has been used as a very effective communication method for visually impaired people all over the world, while being adapted to the language of each country. Recently, with the development of computer technology, a talker system by a computer is becoming a popular method, replacing the Braille system. However, the Braille system which is a great invention is still recognized as an effective method. In that situation, the issue is that it is very difficult to study the Braille system especially for an adult blind, so a proper study system for the Braille system has been strongly desired. Also, it is the case with a sighted person who supports visually impaired people or has to study the Braille system for another purpose. There have been several similar studies of the system which supply the communication tool through fingers with a disabled person by IT technology[1]. In our study, we focus the target into learning and try to use any part of the body other than a fingertip, we are developing a self-learning system of Braille reading and writing for both visually impaired people and sighted people, and we could obtain some collected data which show the effectiveness of this self-learning system.

## 2. The summary of a self-learning system

First of all, we give an explanation of the Braille system itself. It is common all over the world, and one Braille code has 6 points. With the combination of 6 points,

64 characters can be expressed for one cell. Other special characters are expressed using 2 cells like a shift code system. Figure.1 shows the Braille system adapted to the Japanese language.

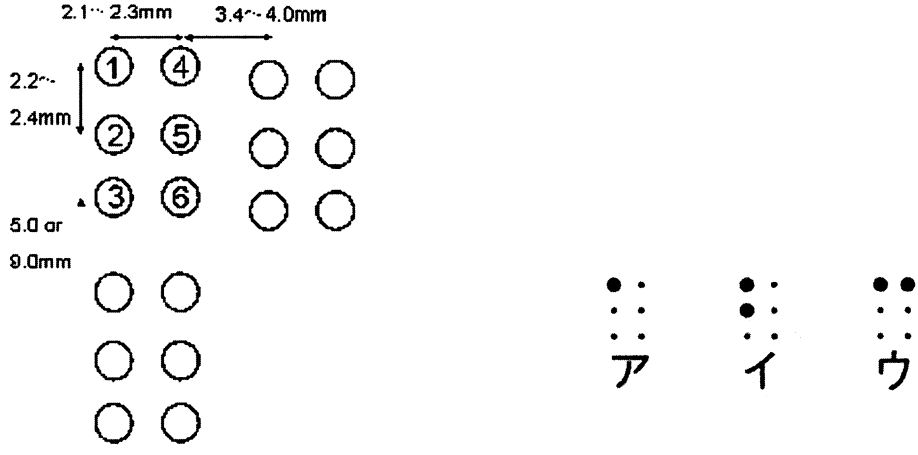


Fig. 1 The Braille system adapted to the Japanese language

As a normal study of reading Braille codes, a visually impaired person used to practice the rule of the Braille system by reading Braille codes printed on a paper using a fingertip, or printing Braille codes on a paper using a stylus. But as the distance between 2 points of a Braille code is very narrow, such as 2 mm, it is very difficult to recognize by using a fingertip. Consequently, many adult blinds had to give up studying the Braille system. In this paper, we propose the new concept of a study system, in which the rules and the presentation are divided, and a learner can study the rule first. For that purpose, 6 micro vibration motors which are normally used in a mobile phone, are adopted to present the Braille code to be read by a learner using any part of the body surface. We named this system "Body-Braille" and have been testing the proper parts of a body, such as fingers, palm, ears, head, abdomen, back, arms or legs[2]. After a learner has mastered the rules and became well accustomed with the Braille system by using the Body-Braille which supplies easy presentation, a learner will practice reading Braille codes printed on a paper or soft copy of Braille codes like a pin display equipment as a next step.

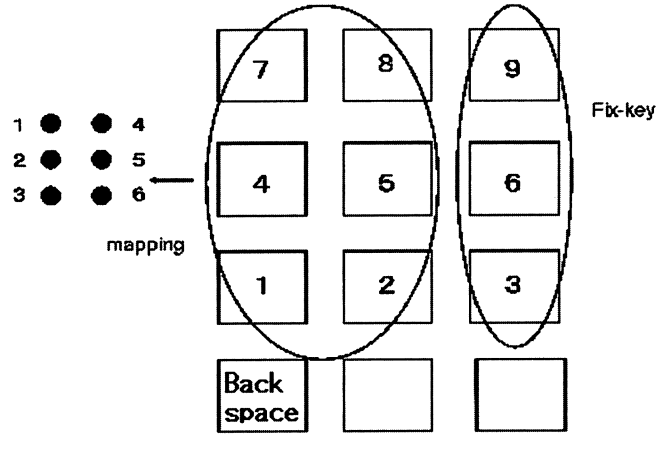


Fig. 2 Mapping ten keys to 6 points of Braille code

As for a study of writing Braille codes, we use an external ten-key box. By mapping 6 points of a Braille code to 6 keys out of 12 keys of an external ten-key box and using 3 keys for fixing the input, a learner types a Braille code data into a computer, and a computer logs the input speed or miss key-in counts. This interface is also effective for a sighted person to type data very rapidly into a computer by a single hand without a full key board. Figure2 shows mapping ten keys. We supply various conditions for the input and the presentation of Braille codes. So this system can be adapted to any level of a visually impaired person, including a sighted person.

## 3. Explanation of self-learning system and the result data

### *3.1. Reading sub-system*

The question data consist of several categories such as "life", "health", "sports" or "politics", and each category consists of several groups of data. Each group has 10 words. For each question word presented by the Body Braille, answer data read by a learner are logged together with the presentation condition such as the simultaneous number of vibrations, the vibrating period or the cell period. Figure3 shows the block diagram and Figure4 shows the example of computer display.

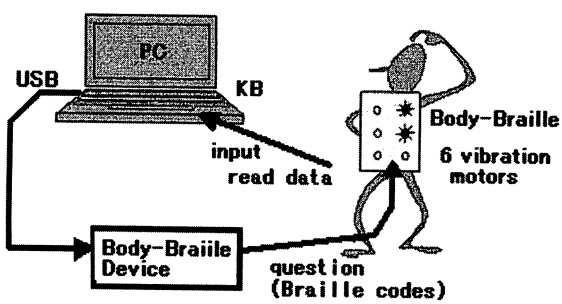


Fig. 3 The block diagram of reading sub-system

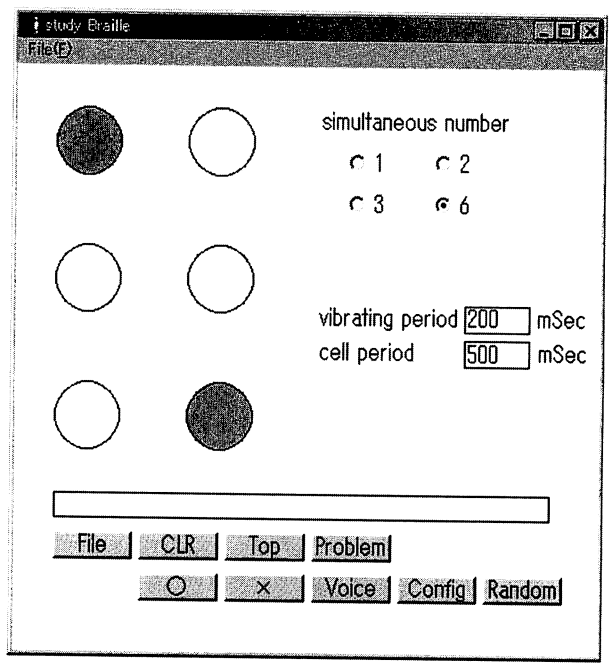


Fig. 4 Example of computer display

### *3.2. Writing sub-system*

The question data consist of several categories such as "mail" or "technology" and each category consists of several groups of data and each group has 5 sentences. For each question sentence which are supplied through a computer display for a sighted person, and through an audio cassette recorder or a MP3 player for a visually impaired person, corresponding Braille code data typed in by a learner are logged together with the data input speed and miss counts. When a learner types a Braille code, a corresponding character is echoed back from a computer as sound. If a learner

makes a mistake, "0" key is used as a back-space key and miss count is incremented. We use two types of an external ten-key box, one is a calculator type, the other is a mobile phone type. The former is operated with 5 fingers shown in the Figure2, the latter is operated with only a thumb whose key mapping pattern is different from the Figure2. Figure5 shows the block diagram and Figure6 shows the example of computer display.

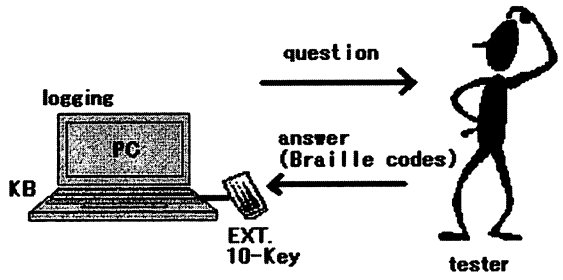


Fig. 5 The block diagram of writing sub-system

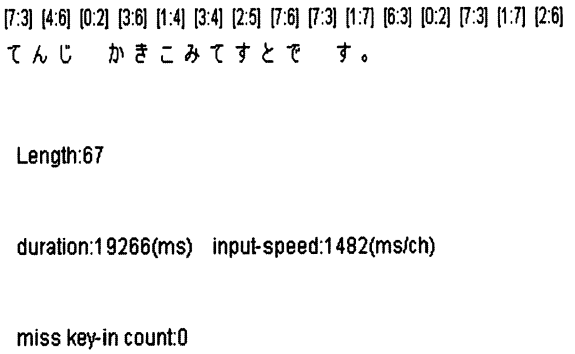


Fig. 6 Example of computer display

### *3.3. Result Data*

The data obtained through the experiment during 3 months are shown in Figure7. In this experiment, a learner repeated the study through the self-learning reading sub-system and writing sub-system. In the Figure7, the average time per 1 character input is shown for both a calculator type and mobile phone type external 10 key box. In each case, the average time is reduced by about 30-50% through the training during 3 months. The average time of a calculator type is less than that of a mobile phone type because 5 fingers can be used in a calculator type whereas only a thumb can be used in a mobile phone type. Unfortunately, we don't have enough result data for the reading sub-system yet, but the key-in speed has been reduced by about 30-50% for the writing sub-system, which indicates the effectiveness of both the reading and writing sub-system.

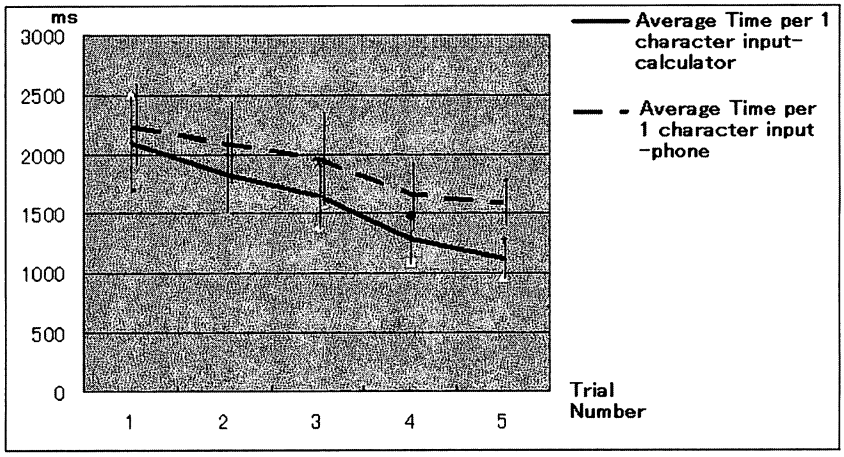


Fig. 7 The measured data of key in speed

## 4. Conclusion

We have been developing a self-learning system of Braille reading and writing for both visually impaired people and sighted people, and obtained some data which expressed the effectiveness of this system. As for a reading self-learning sub-system, the rules and the presentation are divided and by using vibration motors and adjusting the vibration parameters, the easy presentation method can be obtained so that a learner can concentrate on the study of the rules of the Braille system first. As for a writing self-learning sub-system, by mapping keys of an external ten-key box to 6 points of a Braille code, the effectiveness of the system is recognized. In the future, we are going to obtain more data to prove the effectiveness of this system and propose the other interface of reading and writing of a Braille code.

## References

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