1. Introduction

Recently the numbers of talking ATMs (Auto Teller Machines) for visually impaired users have been increasing in Japan (about 36,000 out of 140,000 total ATMs)\(^1\).

There are several variations of talking ATMs and the latest addition to this family in Japan is the tactile symbol type (TST) ATM\(^2\). It adds only a set of convex tactile symbols around a touch screen and an earphone jack to normal touch screen ATMs without hardware keys (Fig.1)\(^3\). It can shorten operational time for most simple ATM transactions thanks to the symbols.

This paper proposes a guideline of tactile symbol related to its simplicity. Producing candidate tactile symbols efficiently is important, and for that purpose, less than four elements should be considered first before other tactile guidelines.

2. Designing Tactile Symbol

Since the tactile perception has a problem of its limited accuracy, previous researches focused on shapes that can be easily recognized. Design guidelines for the “shapes” of tactile symbols have been proposed to this date\(^2, 4, 5\). For example, the following “shapes” should be avoided: inclined lines, overlap of objects such as crossing lines, (three dimensional) perspective view, narrow spacing, thick lines, differences of line length and size of objects, arrow, parallelism, and distant objects. On the other hand, the following “shapes” are encouraged: curved lines and simple objects.

Most guidelines are simple, since some of them need to be used at the same time to create a symbol. However, such a combination tends to bring little solution\(^3\). For instance, when “narrow spacing” and “overlap of objects such as crossing lines” are avoided, there are few choices left other than circles and rectangles.

Therefore, priorities of the guidelines are important. However, there are few guidelines about priorities. Since the guideline “Make tactile symbols as simple as possible” by Takahashi et al. is important\(^2, 4\), it was a big issue on how to use it in the tactile symbol design. This research copes with this issue.

3. Experiment

Referring to existing tactile symbols and visual symbol guidelines, existing standard symbols, symbols taught before high schools, and symbols taught at schools for the blind, twelve people designed in total 122 shapes of convex tactile symbols\(^3\) for ten functions of a TST ATM: Deposit, Withdrawal, Balance Inquiry, Passbook Update, Remittance, Transfer, Other Functions, Cancel, Clear, and Enter. Each person designed at least four consistent shapes of symbols for different functions to make as many consistent sets of symbols as possible.

To test the shapes quickly at low cost, tactile symbols were produced using a paper-based stereo-copying system\(^6\) with the symbol size of 10 square mm, about 1 mm line thickness, and about 0.8mm symbol height according to results of a previous research\(^2\).

Subjects: eight sighted subjects (five males and three females, age 20 - 40).

There were several reasons to use sighted subjects at this stage. The first reason was quick availability of subjects. The second
reason was that there were many persons with adventitious visual impairment who were sighted before.

**Procedures:** The eight subjects tested the 122 shapes, which were stereo-copied onto an A3 size stereo-copying paper, for their tactile perception. After a subject closed his/her eyes, an experimenter randomly placed the subject’s finger on a tactile symbol and asked the subject its shape and its evaluation score. Three possible scores were 2 (easy to identify), 1 (difficult to identify), or 0 (impossible to identify). If the shape was identified incorrectly, the subject was introduced to the correct shape and asked to select either a score 0 or 1. This trial was repeated on each subject for all 122 shapes.

**Results and Considerations:** The subjects scored the shapes from 0 to 2, thus a total score of each shape by the eight subjects ranges between 0 and 16. Fig.2 summarizes this by categorizing symbols into five categories in terms of the number of elements constituting each symbol. For example, ‘-‘ has one element, ‘=‘ has two elements, a triangle has three elements, a rectangle has four elements, and so forth. There are several difficult symbols to count; for instance, ‘+’ is counted four rather than two here.

Fig.2 shows that the identifiable score fell about 25% as the number of elements increased. When all subjects score “difficult to figure out”, the score will be eight. In this sense, less than eight is not good. Additionally, the number of elements equal to five or more is almost impossible to identify. Thus, it is recommended that less than four elements be used to design identifiable tactile symbols. In designing a number of symbols as a set, reducing the number of elements is more important than considering existing tactile guidelines, therefore it is recommended that reducing the number of elements to less than four must come first before considering existing tactile guidelines.

4. **Conclusion**

Producing candidate tactile symbols efficiently is important, and for that purpose, less than four elements should be considered first before other tactile guidelines.

More equipment in the public sector is expected to be equipped with tactile symbols.

**References**


![Fig. 2 Results of First-cycle test](image)