Katakana EdgeWrite: An EdgeWrite Version for Japanese Text Entry

SUMMARY This paper presents our project of designing EdgeWrite text entry methods for Japanese language. We are developing a version of EdgeWrite text entry method for Japanese language: Katakana EdgeWrite. Katakana EdgeWrite specifies the line stroke directions and writing order of the Japanese Katakana character. The ideal corner sequence pattern of EdgeWrite for each Katakana character is designed based on its line stroke directions and writing order.

key words: text entry, text input, EdgeWrite, Japanese, Katakana, assistive technology, mobile interaction

1. Introduction

We are designing a version of EdgeWrite method for Japanese text entry. EdgeWrite is a successful text entry method for preserving high accuracy and stability of motion [1], [5] and for providing high learnability and guessability [6]. A series of research projects conducted by Wobbrock’s group proved that EdgeWrite is a versatile text entry method.

Recently, Kim and Lee [2] designed Korean EdgeWrite, which is a pioneering work for applying the concept of EdgeWrite to an East Asian language. Even though it was a preliminary evaluation, their experimentally obtained result for evaluation showed the high learnability of Korean EdgeWrite. The result suggests that the concept of EdgeWrite is useful for East Asian languages.

The purpose of this paper is to design a version of EdgeWrite for Japanese Text Entry. It contributes to expansion of a design space of the EdgeWrite text entry method as it provides a new application for East Asian languages [3].

2. Japanese EdgeWrite Design

Several challenges exist for designing EdgeWrite for East Asian language such as Japanese. Major challenges for Japanese EdgeWrite design include:

- Large number of characters: Principal part of the Japanese phonogram kana contains 46 characters, each of which has two representations: Hiragana and Katakana.
- More than one line stroke: Each character consists of line strokes—2.35 strokes on average for Katakana.
- No universal unistroke styles of characters: each Hiragana and Katakana character is written as it is.
- Voiced sound marks: voiced consonants introduce sound signs to characters.

The original EdgeWrite employs a square input area bounded by physical edges. Each corner has a unique assigned number: the top-left corner is 1, the top-right corner is 2, the bottom-right corner is 4, and the bottom-left corner is 8. Corner sequences are defined as a sequence of corner numbers, which represents an EdgeWrite character. For example, 2184 is the corner sequence of character “c” in EdgeWrite (version 3.0.5) [1]. We employ the corner sequence notation to design Japanese EdgeWrite.

3. Katakana EdgeWrite

Considering the challenges described above, we specifically examine Katakana as a candidate for Japanese EdgeWrite design because each Katakana character in writing form consists of straight line strokes and is much simpler than Hiragana character.

Katakana characters have different numbers of strokes. The minimum number of strokes is one for no, fu, he, and re, whereas the maximum number of strokes is four for ne and ho. The average number of strokes for Katakana characters is 2.35. This fact suggests a new challenge for designing Japanese EdgeWrite because EdgeWrite is a unistroke input technique [5]. In other words, we need to design kana in unistroke representation.

Detailed analysis of Katakana characters reveals that Katakana consist roughly of straight line strokes made in eight directions (Fig. 1(a)). Based on this analysis, we pro-
pose a Katakana notation with line direction and strokes. In addition, the writing order of each stroke is important to express a character. Consequently, each character is represented as a sequence of line directions. For example, Katakana a is expressed as [(E, SW), SW] where (E, SW) and SW in the brackets denote the writing order of separate line strokes, whereas E and SW in parentheses denote the writing order of continuous line stroke (Fig. 1 (b)).

We define all the Katakana characters in the line direction and stroke notation and translate them into corner sequences. For example, (E, SW) is translated into 128; SW is translated into 28. As a result, [(E, SW), SW] is translated into 12828.

Line directions are categorized into horizontal and vertical directions such as N, E, S and W, or diagonal directions such as NE, SE, SW and NW. Each horizontal and vertical direction can be translated into two corner sequences whereas each diagonal direction is translated into unique corner sequence. For example, E can be translated into 12 or 84 whereas SE is translated into 14. This ambiguity produces various possible corner sequences for a single character.

In summary, we show our design of Katakana EdgeWrite in corner sequence notation in Table 1, which express ideal corner sequence patterns. Some Katakana characters have the same corner sequence in Katakana EdgeWrite. Therefore, it may require a method to disambiguate them such as dictionary-based disambiguation [4].

### 4. User Study

We conducted user studies to investigate the efficacy of our design approach by collecting user-generated corner sequences for Katakana characters. Eleven graduate and undergraduate students participated in the study. They were asked to generate corner sequences by tracing a square edge with a finger under an eye mask. Each participant created three corner sequences for a Katakana character. Table 1 shows the most frequently generated corner sequences. User-generated corner sequences for eighteen characters are the same as the ideal corner sequences. Eight characters have a corner number difference and six characters have two corner number differences.

### 5. Conclusion

This paper presented a version of Japanese EdgeWrite: Katakana EdgeWrite. To design the Katakana EdgeWrite, this paper introduced a new device: line stroke directions and writing order of Katakana characters. Then we translated each Katakana character in eight direction notation into corner sequence notation, which enables prediction of various possible corner sequences for a single character.

### References

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