A PSYCHOPHYSICALLY ENGINEERED JAPANESE FONT SUITABLE FOR TACTILE RECOGNITION

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PURPOSE: Sans serif fonts are well known as the better fonts for recognition and reading via low resolution sensory channels[1)2)3)4)], such as low vision and touch. Narrow Gothic-type Japanese fonts have been used for these channels, whereas tactile recognition performance never be perfect and satisfactory. Here we investigate into a possibility of developing a new psychophysically engineered font suitable for tactile recognition.

METHOD: A set of Japanese Katakana characters were raised for tactile observation using swell papers. Character size was fixed to 1.6 cm in height, where recognition was about 80-90% correct in the previous experiments. Five different font types, ie, Textbook, Mincho (similar to Times Roman) , Gothic-narrow, Gothic-thick, Round-Gothic (Fig. 1) were compared their recognition rate and time. Six Japanese normally sighted and blind-folded subjects touched one character at a time and read alout as quickly and correctly as possible (Fig. 2). Confusion matrices were calculated for each font type. Using principles for better tactile recognition (Fig. 3) we obtained from the analysis of the matrices, a new font called ForeFinger M (Fig. 4) was developed and its recognition performance was compared to those for the above 5 fonts over a range of 0.5 cm through 2 cm sizes with 25% step.

RESULTS and DISCUSSION:

Analyses into confusion matrices showed that each font set has unique strengths and weaknesses. For example, Gothic-narrow was generally good in tactile reading performance, but there were some character-pairs nobody could descriminate by touch (Fig. 5). Interestingly the other font type escaped from the same problem. We extracted the following principles:

(1). minimize number of corners or angles, for even small ones are distracting (Fig. 3)

(2). if there were confusing pairs, contrast difference

(3). use difference in thickness and length rather than orientation difference of sub-parts

Performance of ForeFinger M was evaluated in recognition accuracy(Fig. 6). Two way ANOVA showed that primary effects of font ($F(5.20)=13.627$ $p<0.1$) and size ($F(6,24)=134.46$, $p<.01$) were both significant. From Tukey's multiple comparison, the ForeFinger M font showed a significantly better performance in recognition accuracy over any other fonts. The average accuracy for 2 cm sized characters of the ForeFinger M font was 99% which was never obtained with the conventional Japanese fonts.

Fig.1 Fonts used in this study. All except ForeFinger M are commonly used in Japan.

Fig. 2 Blind-folded subjects touched raised characters to test recognition performance.

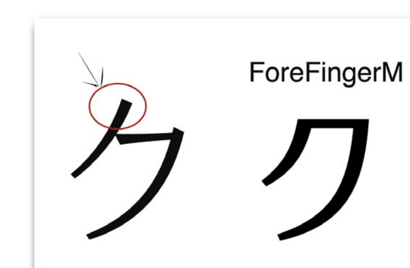

Fig. 3 Policy for a tactile font: Keep it simple by removing any ornamental structure which adds more corners and angles

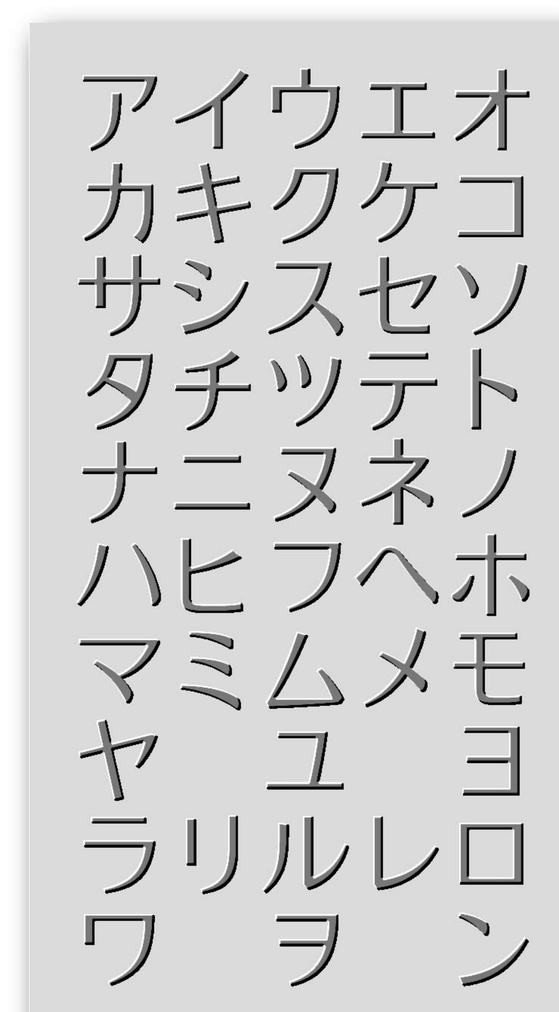

Fig. 4 The ForeFinger M - Japanense characters List

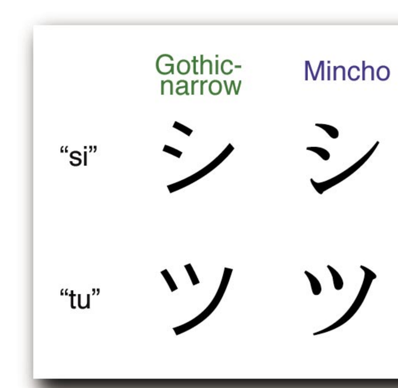

Fig. 5 Very similar characters differ only in orientations of its parts. Thickness difference is critical in tactile recoginition here.

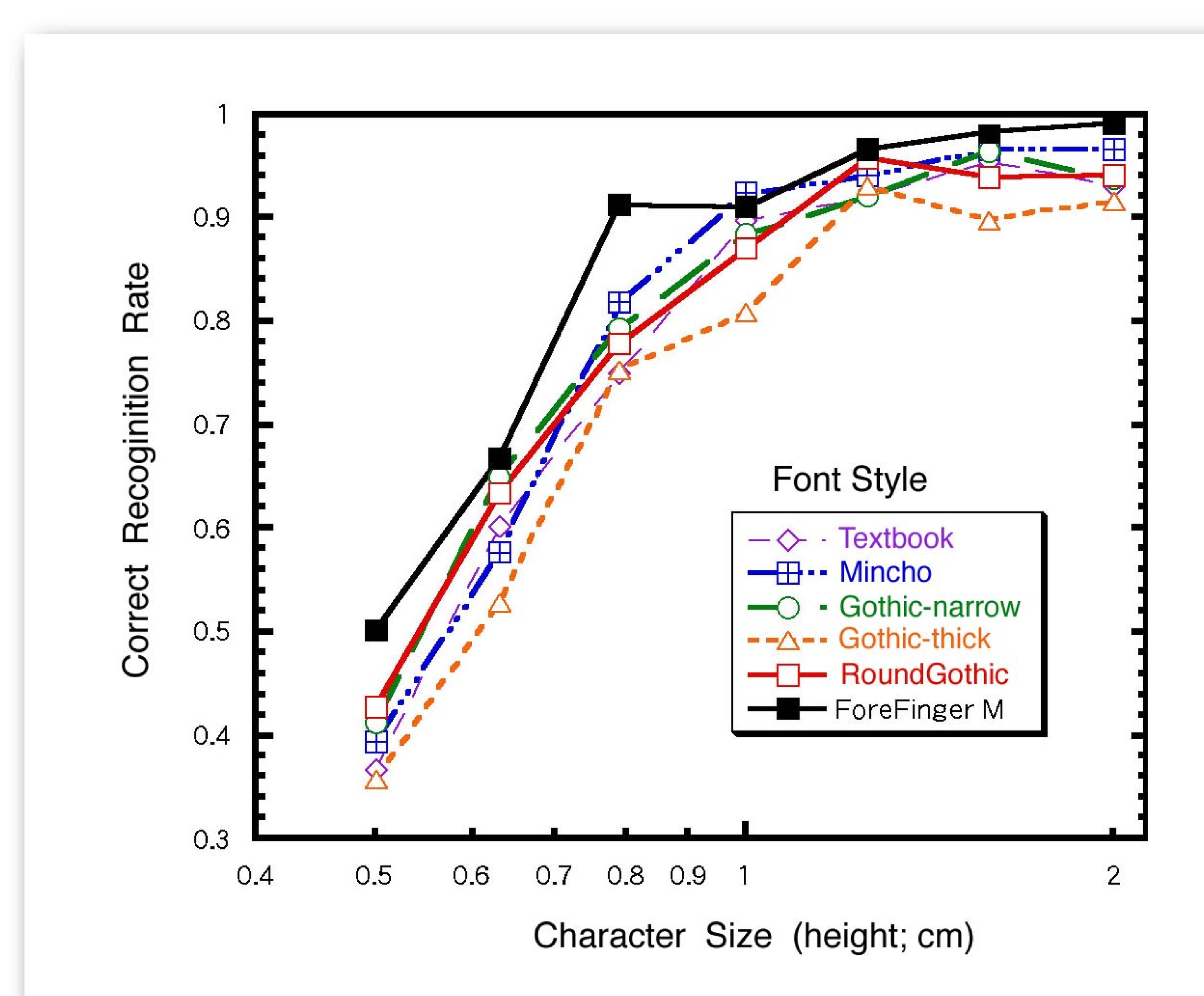

Fig. 6 Recognition performance for 6 fonts over a range of character size. The ForeFinger M beats every other font in every size.

References

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