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Mental Workload while Handwriting Numeric Characters with a Stylus on Tablets

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***Abstract*— In this study, we aimed to evaluate the mental workload caused by handwriting characters with a stylus on tablets. We conducted an experiment to investigate the effects of the screen angle on the mental workload when handwriting numeric characters using the NASA task load index. The relationship between the screen angle and the mental workload was revealed in this study.**

I. INTRODUCTION

Touch screens that enable intuitive operation are used as user interfaces in a wide range of fields, such as, education, healthcare, and manufacturing. Tablets have good portability, which enables the use of fingers or a stylus for input. However, there is limited knowledge regarding the usability of a stylus as an input device. Several studies have been conducted to evaluate the usability of tablets. In most of those studies, usability has been evaluated in terms of objective indices such as reaction time and error rate. However, in addition to improving the performance of the task, it is important to reduce the mental workload related to cognitive information processing.

In this study, we aimed to evaluate the mental workload caused by handwriting numeric characters with a stylus on tablets. We conducted an experiment to investigate the effects of the screen angle on the mental workload when handwriting numeric characters using the NASA task load index.

II. METHODS

The participants were 11 men and women who regularly use touch screen devices. The average age of the participants was 21.4 ± 1.4 years. In the experimental task, the participants were asked to write numeric characters into the frame displayed on the screen using a stylus as quickly and correctly as possible (Fig. 1). The experimental factor was the screen angle (i.e., 0°, 10°, 20°, 30°, and 40°). We adopted the NASA task load index [1] as the experimental index. In this method, the mental workload caused by performing a task is evaluated by using the mean weighted workload (WWL) score. The WWL score can take a value between 0 and 100; the higher the number, the higher is the workload. For statistical processing, we performed an analysis of variance (ANOVA) at a 5% significance level. We also used the Bonferroni method to perform multiple comparisons.

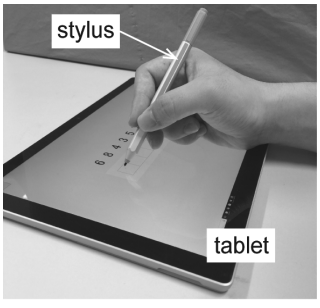

Figure 1. Handwriting characters using a stylus.

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III. RESULTS & DISCUSSION

Fig. 2 shows the result of the WWL score. The ANOVA results indicate that the principal effect of screen angle was significant. As a result of multiple comparisons, we found that the mental workload decreases significantly when the screen angle is 20°. There was no significant difference between the conditions of 20° and 30°.

IV. CONCLUSION

In this study, we conducted an experiment to evaluate the mental workload caused by handwriting numeric characters using a stylus on tablets. In this study, the screen angles that reduce the mental workload were revealed.

REFERENCES

[1] S. G. Hart and L. E. Staveland, "Development of NASA-TLX (Task Load Index): Results of empirical and theoretical research," in *Advances in psychology, Human Mental Workload*, vol. 52, P. A. Hancock & N. Meshkati, Eds., North-Holland, 1988, pp. 139–183.

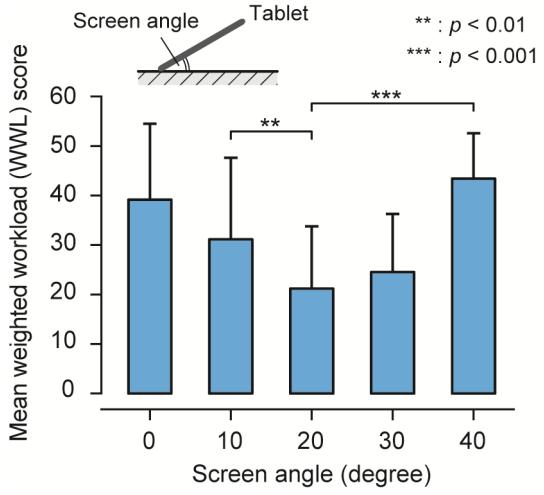

Figure 2. Result of mean weighted workload (WWL) score.