World Academy of Science, Engineering and Technology
International Journal of Biotechnology and Bioengineering
Vol:11, No:08, 2017

Relationship between Thumb Length and Pointing Performance on Portable Terminal with Touch-Sensitive Screen

Authors : Takahiro Nishimura, Kouki Doi, Hiroshi Fujimoto

Abstract : Touch-sensitive screens that serve as displays and input devices have been adopted in many portable terminals such as smartphones and personal media players, and the market of touch-sensitive screens has expanded greatly. One of the advantages of touch-sensitive screen is the flexibility in the graphical user interface (GUI) design, and it is imperative to design an appropriate GUI to realize an easy-to-use interface. Moreover, it is important to evaluate the relationship between pointing performance and GUI design. There is much knowledge regarding easy-to-use GUI designs for portable terminals with touch-sensitive screens, and most have focused on GUI design approaches for women or children with small hands. In contrast, GUI design approaches for users with large hands have not received sufficient attention. In this study, to obtain knowledge that contributes to the establishment of individualized easy-to-use GUI design guidelines, we conducted experiments to investigate the relationship between thumb length and pointing performance on portable terminals with touch-sensitive screens. In this study, fourteen college students who participated in the experiment were divided into two groups based on the length of their thumbs. Specifically, we categorized the participants into two groups, thumbs longer than 64.2 mm into L (Long) group, and thumbs longer than 57.4 mm but shorter than 64.2 mm into A (Average) group, based on Japanese anthropometric database. They took part in this study under the authorization of Waseda University's 'Ethics Review Committee on Research with Human Subjects'. We created an application for the experimental task and implemented it on the projected capacitive touch-sensitive screen portable terminal (iPod touch (4th generation)). The display size was 3.5 inch and 960 × 640 - pixel resolution at 326 ppi (pixels per inch). This terminal was selected as the experimental device, because of its wide use and market share. The operational procedure of the application is as follows. First, the participants placed their thumb on the start position. Then, one cross-shaped target in a 10 × 7 array of 70 positions appeared at random. The participants pointed the target with their thumb as accurately and as fast as possible. Then, they returned their thumb to the start position and waited. The operation ended when this procedure had been repeated until all 70 targets had each been pointed at once by the participants. We adopted the evaluation indices for absolute error, variable error, and pointing time to investigate pointing performance when using the portable terminal. The results showed that pointing performance varied with thumb length. In particular, on the lower right side of the screen, the performance of L group with long thumb was low. Further, we presented an approach for designing easy-to- use button GUI for users with long thumbs. The contributions of this study include revelation of the relationship between pointing performance and user's thumb length when using a portable terminal in terms of accuracy, precision, and speed of pointing. We hope that these findings contribute to an easy-to-use GUI design for users with large hands.

Keywords : pointing performance, portable terminal, thumb length, touch-sensitive screen
Conference Title : ICBCBBE 2017 : International Conference on Bioinformatics, Computational Biology and Biomedical Engineering
Conference Location : Amsterdam, Netherlands
Conference Dates : August 07-08, 2017