

Exploring Thumb Input Performance for Pointing and Dragging Tasks on Smartphone

Yotaro Matsuura

Smartphone ownership has been increasing around the world in recent years, with smartphone ownership in Japan reaching 75% in 2017 and is still on the rise. According to previous research, 49% of smartphone users mainly use smartphones with one thumb. In addition, there are many situations where a smartphone must be used with one thumb, such as in a train or holding a bag. However, it is said that more erroneous operations occur with one-handed thumb than using a smartphone with both hands and using a touch pen. This comes up with various problematic situation such part of screen is occluded due to the thumb position and the unreachability of thumb in some parts of the touchscreen. However, it is not clear how each factor such as the location of the target and the size of the smartphone affects the smartphone operation. There is also a little research on how various factors such as posture and target size affect user task performance.

This study investigated the effects of various factors such as smartphone size, user hand size, target size, posture. In addition, it validates the fitness Fitts' law model in predicting finger movement time between selecting consecutive targets for smartphone pointing and dragging tasks. This study collected data on touch position, time, acceleration sensor, gyroscope, and hand size by conducting experiments on about 12 participants using an application that randomly displays targets. We also provided a visual summary for pointing time and error rate.

It has been observed that small smartphone is easier to operate under many conditions, but as the size becomes larger, it is necessary to improve one-handed input. The size of the target should be at least 1.5 cm, less than that error prone for most of the time. On large smartphones, target placements that demands moving the finger to the W direction are not recommended. Fitts' law model is more or less fits with both pointing and dragging task results of one-handed thumb input of smartphones, however, in dragging operations where the effect of target distance is greater than target size, the model could be improved. Fitts' law model fit our data by changing the slope value according to the posture and the size of the smartphone.

(Advisor: Sarcar Sayan)