Characterizing Body Input Combinations with Fitts' Law Parameters

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1 ABSTRACT

Current input devices are generally controlled via one modality only. This limits the transmission bandwidth - i.e. the rate of information transfer - between users and interactive systems. On the other hand, input devices taking advantage of multiple modalities in parallel could have the potential to increase this transmission bandwidth. We propose to characterize body input combinations from an Information Theoretical view point using Fitts' Law parameters to compute combinations bandwidth.

2 Fitts' Law

Fitts' law applied to the conventional pointing operation models the pointing behavior of the human pointing action in the real space, and the time (MT) required for moving to the target is a rule that it depends on the index of difficulty (ID) represented by the target size W and the moving distance D. According to Mackenzie and colleagues 'research on extension of Fitts' law to two-dimensional pointing operation, the difficulty ID required for pointing operation is given by equation1 when the target size W and the movement distance d are as shown in Fig.1 Respectively. By using the constants a and b derived by the experiment at this time, the travel time MT is expressed by the equation2.

$$Index\ of\ Difficulty \qquad ID = log_2\left(\frac{d}{W}+1\right) \quad (1)$$

$$Movement\ time \qquad MT = a + bID \quad (2)$$

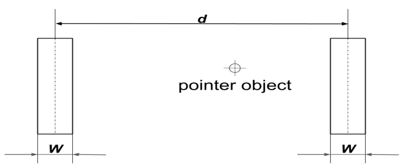

Figure 1 Fitts' law paradigm

3 METHOD

3.1 Experimental outline

We aim to characterize and compare the transmission bandwidth of 12 body limbs combination during a 1D pointing task.

3.2 Experiment contents

We conducted experiments on 51 participants(36 males, 15 females). Experiments were conducted using 5 combinations of 6 types of bodily input gestures to point to repetitive targets. 16 kinds of difficulty were set for each gesture, this was done twice, and 16 × 16 trials were made by combining two gestures. Gesture (Fig2) was devised with reference to the set of Balakrishnan et al.

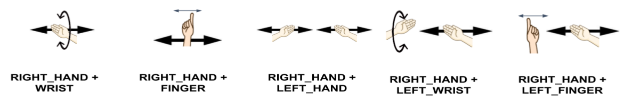

Figure 2 Gesture set

4 RESULTS

The performance evaluation values of each gesture obtained from the experiment are shown in Fig3.

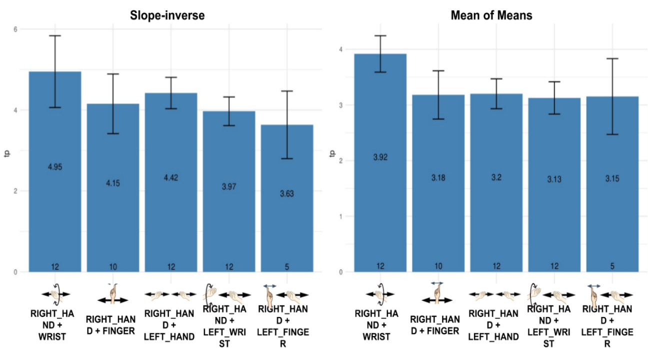

Figure 3 Experimental result

5 SUMMARY

In this paper, the transmission bandwidth of the combination of limbs is compared and reported. The future task is to add more limb combinations and propose the most effective interaction paradigm.

References

[1] Ravin Balakrishnan, Scott MacKenzie, "Performance Differences in the Fingers, Wrist, and Forearm in Computer Input Control", CHI97, 22-27 1997.