Joystick Text Entry with Date Stamp, Selection Keyboard, and EdgeWrite

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MOTIVATION

Mobile phones and game consoles are two domains in which a good joystick text entry method would be valuable, since these devices lack conventional keyboards. Joysticks have considerable tenure as input devices, but few text entry methods have been developed for them. Common joystick text entry methods, like date stamp and selection keyboard, are selection-based: they require screen real-estate to display options, are difficult to customize, cannot be used without looking, and are slow. A *gestural* joystick method, on the other hand, could alleviate these limitations in exchange for the need to learn letter-forms. If the letter-forms were easy to learn, such a technique could have significant advantages over current methods.

WRITING WITH A JOYSTICK USING EDGEWRITE

The EdgeWrite input technique [1] designed for use with a stylus on a PDA has an alphabet amenable to joystick text entry. The alphabet is quick to learn due to its Roman-like letters. What's more, the square that bounds the input area provides physical stability, crucial for writing with low-precision devices like joysticks. EdgeWrite letters are made by pushing the joystick along the physical edges and into the corners of the square, removing any need for careful loops or arcs, as, for example, would be required by Graffiti letters. Recognition only depends on the order the square's corners are hit, not on the stroke path, so wiggle and jitter do not deter high recognition rates. Segmentation between letters is accomplished when the joystick snaps-to-center.

EXPERIMENT

We implemented joystick versions of date stamp, selection keyboard, and EdgeWrite for the Saitek P2500 game controller, which without modification has a square area bounding the stick. Date stamp is the roll-over method used on high-score screens in arcade games. Selection keyboard is an on-screen keyboard with a movable selector over its keys, found in at least two Xbox games and the Xbox Live! registration, all of which use an alphabetic layout.

We compared these 3 methods in a single-factor within-subjects study of 18 subjects who had never before used EdgeWrite. Entry method was fully counterbalanced across subjects. Subjects practiced for 5 minutes with the selection-based methods and for 15 minutes with EdgeWrite, since they had to learn the gesture alphabet. We acknowledge that EdgeWrite takes longer to learn than the selection-based methods. Our goal was not to create a more learnable method, but one that offers higher speed and better accuracy with a small amount of practice.

Testing consisted of entering a set of 10 phrases with each method. Set assignment was even across method. Subjects were instructed to proceed "quickly and accurately" while testing, and could correct errors with each method's backspace operation as they saw fit.

Results

Data were analyzed using a mixed model ANOVA. Means are reported for tasks 2-10 due to learning in task 1. Results are reported below in this order: EdgeWrite, date stamp, selection keyboard. Standard deviations are in parentheses.

Subjects were fastest with EdgeWrite: 6.40 (1.60), 4.43 (0.62), 6.17 (1.18) words per minute. Contrasts show EdgeWrite was faster than date stamp ($F_{1,466}=363.80$, $p<.01$) and selection keyboard ($F_{1,466}=5.11$, $p<.025$).

Subjects left fewer errors with EdgeWrite: 0.27% (0.96), 0.62% (1.58), 0.72% (2.67) uncorrected errors. Contrasts show EdgeWrite yielded more accurate results than selection keyboard ($F_{1,466}=6.24$, $p<.02$), and nearly so than date stamp ($F_{1,466}=3.68$, $p=.055$). This may have been because EdgeWrite requires no secondary focus of attention, unlike the selection-based methods.

Subjects committed more errors *during* entry with EdgeWrite: 10.58% (7.59), 4.62% (7.23), 2.60% (4.01) corrected errors. Contrasts show EdgeWrite was more error prone than date stamp ($F_{1,466}=73.61$, $p<.01$) and selection keyboard ($F_{1,466}=132.16$, $p<.01$). But curiously, in keeping with the previous result, subjects corrected significantly more errors during entry with EdgeWrite ($F_{2,466}=7.39$, $p<.01$), producing, in the end, more accurate phrases in less time.

REFERENCES

1. Wobbrock, J. O., Myers, B. A., and Kembel, J. A. EdgeWrite: A stylus-based text entry method designed for high accuracy and stability of motion. *Proceedings ACM UIST 2003.* Vancouver, B.C., 61-70.