A Flying Click Gesture For Unary Selection and Activation

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ABSTRACT
In some situations a user needs to select or activate a single control when no other controls are plausible candidates. By reducing the precision required to complete the task we can reduce the target acquisition and activation time. In this paper, we describe the flying click (flick) gesture and its suitability for the selection and activation of single targets. Through experimental results we demonstrate that the flick gesture is faster and less variable for the selection of unary targets.

Keywords
Fitts’ law, interaction techniques, user input, selection tasks, graphical user interfaces.

INTRODUCTION
In many situations, one particular control in an interface has special significance during an interaction. For example, when a user selects the Print command from a menu, a dialog box appears that allows them to modify settings and then initiate the printing action. The OK button has an overriding importance in this interaction because it can be activated at any time to start printing and must be activated at some point to successfully print. We propose that in these situations, a gesture, faster or more efficient than conventional interactions, could be associated with specific controls to streamline their selection or activation. In this paper we examine a subset of this class of interactions, situations where it is known to both the user and the system what the next action will be. This type of unary task is poorly served by current interaction styles in GUis but can be exploited by a flick gesture.

Flying Click Gesture
The flying click or flick gesture is accomplished by pressing and holding the left mouse button as you move the mouse pointer. Once you have moved the pointer a minimal distance, the mouse button can be released completing the gesture. This gesture can also be described as a drag towards the target. The advantage of the flick gesture is that precise target acquisition is not required. The user can perform the flick gesture within a practical minimum of 6 or 8 pixels of the current mouse location. After completing the gesture they can easily resume their previous activity without a large repositioning effort.

EXPERIMENT
An experiment was conducted on a Pentium based personal computer running Windows 95, using a 17” monitor in SVGA (1024x768) mode. Participants used a Dell two-button mouse and standard keyboard. Only right-handed subjects were used for the experiment. The experiment software logged all mouse clicks, mouse up, and mouse down events with the corresponding time and position of the mouse pointer during the event. Participants were presented with a screen that contained two command buttons, (20 pixels square) one located in the center of the screen and one that was randomly positioned between 20 and 300 pixels away from the center button. This “outer” button was repositioned after each trial using polar coordinates to uniformly distribute its position in terms of distance and angle. The experiment consisted of three different tasks, presented to participants in blocks of 50 trials.

- Click: The participant was instructed to click on the outer button, then click on the center button as quickly as possible.
- Enter: The participant was instructed to click on the outer button, then press Enter with the same hand, as quickly as possible to activate the center button. The Enter gesture was used to determine whether or not allowing a control to be activated by a shortcut key was efficient.
- Flick: The participant was instructed to click on the outer button then perform a flick in the general direction of the center button.

The order of presentation was varied across participants. The participants were given three trials of training with on screen instructions for each condition to practice before the block began. No data was collected during the training. A within subject design was used for data analysis.
RESULTS
Figure 1 shows a comparison of mean duration (task completion time) over the three conditions. Each point in the plot represents the value for one of the 18 participants in each of the conditions. To conserve space we have included the data for all of the conditions on one plot. However, we are not comparing the three conditions against one another in a single analysis of variance; rather, we are comparing results of the Flick condition to results of the Click and the Enter conditions independently. We used two-tailed t-tests for all comparisons. There was no order effect between the three conditions observed.

Flicking is significantly faster than clicking (t(34) = 3.053, p = 0.0044), taking 692 ms on average compared to 940 ms. The Flick condition is not significantly faster than the Enter condition (t(34) = 0.294, p = 0.7708), at 716 ms. Figure 2 shows a comparison of the standard deviation of duration over the three conditions. Flicking shows less variability than clicking, at 227 ms versus 314 ms, but the difference is not significant (t(34) = 1.497, p = 0.1437). Flicking is however significantly less variable than pressing Enter, at 793 ms (t(34) = -2.112, p = 0.0421).

Our results are explained by Fitts’ law. The experimental conditions for the Click condition match the requirements of Fitts’ law tasks: we asked participants to carry out the selection task as quickly as possible, and their efforts produced only a small proportion of target acquisition errors (4%). The mean duration for clicking is then governed by the equation \( T = a + b \log_2 \left( \frac{A}{W} + 1 \right) \).

Because we hold the size of the target approximately constant [1], variability in \( T \) is due to \( A \), the distance between the target and the starting position of the pointer. The Flick condition effectively renders this distance constant. Once the mouse begins moving, the duration is determined by the time it takes to execute a single click action. This also explains why the Flick condition showed less variability than the Click condition. A shorter distance is associated with less inherent neuromotor noise for rapid aimed movement [2].

For similar reasons, we found less variability in the Flick condition than in the Enter condition. Perhaps unexpectedly, flicking was no faster than moving the hand to the enter key. One might intuitively expect that because the distance that the mouse moves in the Flick condition is so much smaller than the distance to the Enter key, flicking should be much faster than entering. This turned out to be an artifact of our data collection. If we measure the entire end-to-end task time, which includes the hand returning from the keyboard to the mouse, we find the difference between flicking and entering to be much greater.

CONCLUSION
We have demonstrated that in non-ambiguous situations where precision is not necessary the flick gesture is 26% faster than the conventional click gesture on a button. While the flick gesture is comparable in duration to the enter gesture, the flick gesture is superior to the enter gesture in terms of the time required for the user to “recycle” or get ready for the next task.

Users found the flick gesture potentially useful. There was some difficulty training participants to perform the flick gesture since it was novel to them. Most participants did not distinguish between the instructions “click then drag” and “drag.” After becoming accustomed to clicking on the outer button before the flick gesture was performed, many participants initially dragged all the way to the center button in the early trials. As the trials progressed the length and duration of the drag decreased.

It would be desirable to extend the flick gesture to the selection of multiple controls. We intend to look at the suitability of the flick gesture for the unambiguous selection and activation of a single control when multiple targets are presented.

REFERENCES