

THE EMPIRICAL STUDY OF STROKE-BASED SCROLLING TECHNIQUES IN PEN-BASED INTERFACES

JIBIN YIN^{1,2} AND XIANGSHI REN¹

¹School of Information
Kochi University of Technology
Tosayamada-cho, Kochi 782-8502, Japan
ren.xiangshi@kochi-tech.ac.jp

²Key Lab of Computer Science
Kunming University of Science and Technology
Kunming, P. R. China

Received September 2008; revised April 2009

ABSTRACT. *This study presents a quantitative analysis of stroke-based techniques for scrolling in pen-based interfaces, and compares them with traditional scroll bars. We classified stroke-based techniques into two types: the Arc stroke technique uses angles to determine scrolling direction and the displacement of scrolling, and the Line stroke technique uses distance to determine both the direction and the displacement of scrolling. Experiments were conducted to evaluate stroke-based scrolling techniques in small, medium and large screens respectively. This study also applied a speed mode to the stroke-based techniques. The evaluation results indicate that the Line technique outperforms both the Arc technique and the traditional Scroll Bar. The size of the screen and the scrolling direction (vertical or horizontal scrolling) have no significant effect on the evaluation results of the three techniques.*

Keywords: Scroll, Stroke-based interaction, Pen-based interface, Scroll Bar

1. **Introduction.** Scrolling is a fundamental task in graphical user interfaces. In traditional mouse-based interfaces, scrolling is typically accomplished by rolling the wheel on a mouse or with a scroll bar - dragging the “elevator”, clicking on scroll arrows, or clicking in the space between the arrows and elevator.

However, pen-based devices lack scrolling widgets like wheels and pen-based interfaces have different characteristics to mouse-based interfaces, suggesting that an alternative to Scroll Bars might be more appropriate for use with pens. In particular, stroke-oriented gestures are often considered to be more natural in pen-based interfaces. Therefore, in this paper we examine stroke-based interfaces for scrolling. Although there are some studies on stroke-based scrolling techniques [14-16], they all utilize arc strokes to perform scrolling tasks. We have found line strokes to be very suitable for scrolling performances. The literature lacks a careful, quantitative analysis and comparison between arc and line strokes for scrolling on pen-based devices. Furthermore, studies have not considered the relationship between scrolling speed and the length of documents, the effect of screen size or scrolling directions.

Therefore, we look at stroke-based scrolling techniques in order to answer the following questions:

- What are the differences between arc and line strokes to perform scrolling tasks?
- Can the application of speed modes (independent or dependent modes) related to the length of the document offer benefits to stroke-based techniques?