Abstract

A Study of the Relationship Between Human Performance and EV Texture in Haptic Pen Interface

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Recently, pen-based devices are widely used in computer graphics system by designers, artists and architects. Pen-based interaction has also become a factor standard input method for large-scale smartphones and tablet computers. EV-Pen was developed by leveraging electrovibration technology in pen-based interaction for providing haptic feedback for touchscreen, which could help people do precise operations and make them feel like using different kinds of pens on real papers. But currently, the EV-Pen only considers one kind of the pen-tip material and pen-tip width, this might limit its usable range and influence on user experience.

In this thesis, "EV texture" was defined as a feature including pen-tip materials and pen-tip widths, as well as amplitudes and frequencies generated by system signal generator, which would have effect on EV-Pen feedback feeling while using. This work has been done which try to change EV textures in two tasks, including basic interaction aspect and drawing application aspect, to evaluate and compare user performance while using EV-Pen with different kinds of EV textures.

To evaluate the user performance in basic interaction aspect with different EV texture, a steering task, which has been widely used as a theoretical framework for computer input device evaluation, was conducted. This work investigated and quantified the differences between user performance of using two pen-tip materials and three pen-

tip widths of EV-Pen. The experimental results can be employed in user interface design for EV-Pen devices.

To better understand the relationship between user performance and EV texture in application aspect, this thesis examined user's gesture drawing performance in a gesture stroking task. In this work, the performance of users using different EV texture of EV-Pen have been quantitatively and qualitatively analyzed. This work provided a guideline for the application and hardware designs of EV-Pen.

In summary, this thesis contributes to basic understanding of the relationship between different pen characteristics and human performance in the field of haptic pen interaction. The conclusions drawn in this thesis will be beneficial to future studies and designs of EV-Pen device.

key words Pen-based interaction, electrovibration pen, steering task, gesture stroking, human performance.