Interaction Concepts for Digital Concept Sketching

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1 Introduction

While interfaces for digital painting have been investigated in some detail, interaction dedicated for digital drawing and sketching has not received as much attention. We therefore explore new interaction concepts for digital drawing and present a system tailored to freehand sketching with a pen tablet. Because the interfaces of traditional graphics software are often complex and not aimed toward fluid freehand sketching, our goal is to provide a minimal and intuitive interface that meets the demands of this task. To this end and inspired by recent work on interfaces in sketch-based modeling and NPR (e. g., [Bae et al. 2008; Vandoren et al. 2008]), we reduce the complexity of the interface and the need for explicit mode changes. We employ location-sensitive, gestural control for the placement and orientation of the canvas, introduce an analogue gestural control for transformation of strokes which allows people to directly access basic stroke transformations, and extend brush-based editing tools for locally redefining the shape of strokes.

2 Interaction Concepts

A striking difference between a traditional sketching setup and a digital one is the way the artist interact with the actual canvas. In traditional sketching, the sketchbook can be held or placed freely by artists and rotated to their liking. In digital drawing, however, the canvas is typically aligned with the computer screen. We focus on developing integrated pen-based interaction techniques: the use of the screen border as an active interface element that allows pen-based manipulations of the canvas and of strokes or groups of strokes. We use the analogy of touching the border of a piece of paper with a single finger and moving the finger either along or perpendicular to the border (similar to RNT [Kruger et al. 2005]). Motions parallel to the frame invoke rotations, motions perpendicular to the frame invoke translations, and motions starting in the corners are used for zooming (Figure 1). Interaction with strokes are invoked similarly, using the selection frame.

We also allow artists to locally reshape strokes by nudging the strokes with the pen. In addition to a simple, circular interaction point, artist can also define a complete stroke as interaction element to be used to nudge others. Further, selection and erasing of strokes are also possible with pen gestures: drawing a line across several strokes selects them or erases them, respectively.

In our implementation we employ a vector-based stroke representation to enable both continuous interaction without loss of visual quality and high-quality output. The strokes are triangulated to exploit graphics hardware for rendering. Scalability is provided though a LOD mechanism in the stroke model using merge trees to expand and collapse vertices of triangle strips as necessary due to zooming or reshaping interactions. Also, range queries of strokes are enabled using an efficient quadtree datastructure.

3 Evaluation

We evaluated the proposed concepts in an informal observational user study and found that they were generally well received by both of our user groups: artists and novices. Artists proficient in digital

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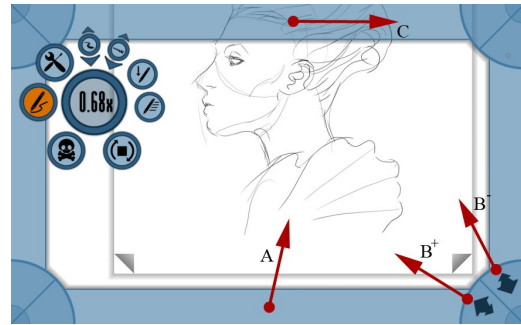
Figure 1: *Canvas manipulation; the arrows depict the click & drag motions: A—translation, B—zoom, C—rotation.*

Figure 2: *Artwork created with the sketching application.*

drawing particularly liked the notion of a directly manipulable canvas, and novices were especially attracted by the ease of learning and use. We found that, in particular, artist made frequent use of the canvas interactions and commented that the interface was comfortable to work with. Novices could immediately start drawing with our application, quickly adopted the new interaction methods, and enjoyed the ease of use and simplicity of the system.

4 Conclusion

A small set of consistent, location-sensitive gestures allowed us to control both canvas and strokes in a unified way, using a vector-based stroke representation for transformations and reshaping of strokes. In addition, we provided brushes for locally altering the stroke shapes. We evaluated the benefit of the proposed interaction concepts in an informal user study, in which we found that our concepts were easy to learn and use for novices and were well received by people proficient in digital drawing.

References

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