

Master Thesis Proposal: Shape Editing for Pen-Based Tabletops



CHALMERS

Background and state-of-the-art:

Users being involved in time-critical planning with interactive maps (for instance in crisis management) are acquainted with the extensive use of various physical tools like pens, whiteboards, or maps; in order to share knowledge with each other and collaborating in creating a Common Operational Picture of the crisis to respond to. Moreover, since time is critical for the people in crisis solving, there is a great need for technologies that can efficiently improve the whole collaboration process. Previous research has demonstrated¹ that tangible tabletops can help to overcome this problem [1]. The t2i-lab has been working on tangible crisis management for more than two years. For this purpose, we have built an interactive table together with tangible devices and an information visualization framework prototype. The framework allows creating crisis management scenarios using Google Maps-based Flash applications.

One of the most important features of a tangible crisis management application is believed to be shape editing. Indeed, crisis management experts often draw shapes on paper maps, for instance in order to represent the spreading of a fire. Those shapes are associated with thematic, spatial and temporal content: in the case of a fire, a shape may represent an area that is burning at a specific date. Therefore, a first problem is **how to draw shapes on a map, and how to associate temporal and thematic content with them**. When users receive data about the evolution of a phenomenon, they want to model this evolution using time-dependent shapes (Fig. 1, center and left). This raises two problems, firstly **how tangible interaction can make the editing of a shape easy and intuitive**, secondly **how a user can modify shapes while still being able to keep track of their associated temporal, spatial, and thematic contents**. In one related example, Igarashi et al. [2] presented algorithms and applications for the artistic domain that may indicate solutions to our project. In our early realization (Fig. 1, left) we have employed a parametric curve descriptions native in the Flash libraries.

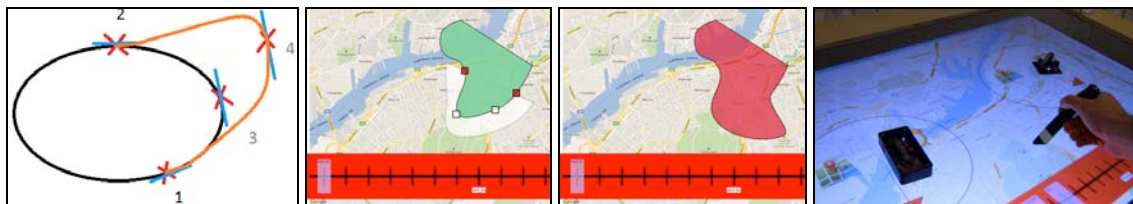


Figure 1 (left to right): Three points (1-3) mark on the original shape in black with tangents at those three points shown in blue. Dragging and dropping the middle point from location 3 to 4 triggers arcs 1-3 and 2-3 to be re-drawn to match tangents at 1, 2, and 4. Examples of this are shown second and third, both at the same time: An original shape (second) and the result of an edition where the bottom-right white square was dragged away from its original position (third). Interaction on the table is shown right.

Problem description and research issues:

- Examine and suggest solutions for drawing shapes on a map while associating temporal and thematic content with these shapes
- Examine and suggest solutions related to transparency of one/multiple layers on top of the map.
- Suggest specialized tangible tools to accompany the pen for use on the tabletop.
- Design/engineer and realize hardware for a new tangible tool tailored to this particular use.
- Design, run and evaluate user studies validating the usability and acceptance of the solutions.

Practical information, advising, place of work, etc.:

Background Computer science/interaction design; programming skills, graphics, user interfaces
Place of work Chalmers, t2i Lab, Lindholmen Campus, Gothenburg, Sweden (www.t2i.se)
Start date As early as possible, preferably September 2011
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Selected References

- Christoph Ganser, Adrian Steinemann, and Andreas Kunz. 2006. InfrActables: Multi-User Tracking System for Interactive Surfaces. In Proc. of the IEEE conference on Virtual Reality (VR '06). IEEE Computer Society, Washington, DC, USA, 253-256.
- Takeo Igarashi, Tomer Moscovich, and John F. Hughes. 2005. As-rigid-as-possible shape manipulation. ACM Trans. Graph. 24, 3 (July 2005), 1134-1141.

¹ Video demonstration: http://www.icvr.ethz.ch/ConfiguratorJM/publications/InfrActabl_121934434202878/197_wmv