Interactive Annotations on Large, High-Resolution Information Displays

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ABSTRACT

We provide the capabilities to interactively create annotations for high-resolution information displays using low-resolution input. These types of annotations are important during collaborative information exploration to externalize parts of the exploration process for the collaborators. We provide the possibility of using direct touch-input with pen or finger at a low resolution to write or draw annotations. These are made available as Sticky Notes that can then be used without major costs in rendering time and screen-real-estate on a high-resolution display.

Keywords: Large, high-resolution tabletop displays, interactive annotation, Sticky Notes, lens interaction.

1 INTRODUCTION

Large interactive displays provide great potential for information visualization. They will allow us to collaboratively explore and make sense of information. When collaboratively exploring a dataset, the externalization of the exploration process becomes important as the information analysts need to share their individual experiences and interpretations of the data. This externalization can be given through speech for synchronous collaboration processes but needs to be stored to share over time. For externalizing aspects of the exploration process labels and annotations are always key factors. In fact with digital information, providing reasonable techniques that support interactive annotation or readable and understandable labeling are difficult enough that they are often left for future work. On large displays, the annotation and labeling process is increasingly difficult since the input is often limited to touch or pen-input decreasing the options given on a desktop computer. Imagine trying to annotate a small leaf node in a large tree layout or accessing information in a very dense parallel coordinate layout. For a high resolution display, a finger—as a touch input—is quite a blunt instrument and might not be able to select or annotate small information displays. That is it will draw a very thick line which is inconveniently large for our high-resolution information.

We will look at how to enable annotations on a touch-sensitive, high-resolution display. We are not at this point addressing labeling layout issues. We provide interactive Sticky Notes for annotation that can be drawn at low resolution and then scaled to be added as annotations to our information display at higher resolution.

2 INPUT ISSUES WHEN ANNOTATING

With common desktop computer setups annotations are usually done via the keyboard. Handwriting with a mouse is a difficult skill to learn and typing tends to be faster even than handwriting. While this does make for neat typed annotations, the switch of input mode from mouse to keyboard can be disruptive for and the resulting annotations are not identifiable as belonging to a particular person during collaboration. This latter identification issue, however, can be readily addressed if the people creating the annotations include an identifier tag in the annotation.

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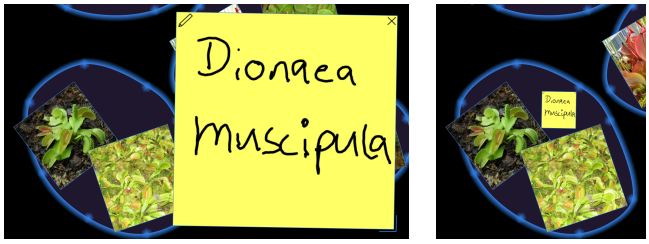
For touch-sensitive displays, virtual keyboards or separate keyboards attached to the computer driving the display can support textual annotation input but both are not a perfect solution. Separate keyboards break the continuity of the interaction because they require switching from touch interaction to keyboard input and back and need to be shared during collaborative information analysis tasks. Virtual keyboards are not well suited either because they not only occupy a fair percentage of the screen real estate, are not part of the information display, and also do not have the same tactic feedback as real keyboards and, thus, are difficult to type on.

With solely using touch input the situation is quite different. One can readily write with a finger tip or with a touch input pen and, as with all hand writing, the results are personal and identifiable. Also, if the information exploration, organization, or categorization tasks are being conducted via touch input, there is no input mode shift disruption of the cognitive task.

However, for vision-based touch input the lines with which one can write are fairly thick (Fig. 1(a)). If, on the other hand, the display resolution is sufficiently high to display dense information spaces hand-written annotations do not need to be displayed at their input resolution. Instead, they can be scaled down from their coarse input resolution to take advantage of the high display resolution (Fig. 1(b)). Users can subsequently interact with the scaled-down annotations using lenses on the interface. These lenses allow one to view the annotations and/or other objects at larger sizes or to displace them in the information space.



(a) Interactive annotation (writing using finger or pen) at input resolution.

(b) Display using high display resoluton.

Figure 1: Creating annotations at a coarse input resolution and displaying them smaller using the display's high output resolution.

3 ANNOTATION INPUT ON TOUCH-SENSITIVE DISPLAYS

We demonstrate a different approach to input text or small sketches to support a natural way of personalizing information exploration on a touch-sensitive display. Our approach is guided by the casual interaction of several metaphors developed previously [3, 4].

3.1 Interactive Sticky Notes

Inspired by the ubiquitous use of sticky notes in today's workplaces, we implemented Sticky Notes to facilitate the interactive annotation of information on touch-sensitive interfaces (Fig. 2). They support the direct interaction paradigm common on touch-enabled interfaces since they can be directly written and drawn on using the user's finger or a pen. This simulates the known interactions with real drawing or finger-painting.

The use of direct writing and sketching input on touch-sensitive interfaces has the additional advantage that it does not require char-

acter recognition as done in previous systems [1], in particular, when used for sketching out hypothesis, insights, or notes during the information exploration process. Here it is of higher importance that ideas and concepts are developed rather than finalized. Therefore, the written annotations and textual or graphical elements rather support this creative use of touch-enabled interfaces.

3.2 Implementation

Our tabletop interaction system is based on OPENGL and an underlying buffer concept for the interface components [2] to facilitate responsive interaction. Therefore, to provide an interactive drawing and writing experience, the Sticky Notes are also implemented with short rendering times in mind. To facilitate this, they are using hardware-accelerated P-buffers provided by modern graphics hardware that allow offscreen-rendering of the Sticky Note contents, which is in turn assigned to a mip-mapped texture map for the actual rendering. This way the drawing routines of OPENGL could be used for drawing lines onto Sticky Notes. Our goal is not to slow down the high-resolution information display and interaction with the display through the use of Sticky Notes.

4 Case Study: Organizing Information on a Tabletop Display

In a case study, we created a large information display in form of a number of images on a touch-enabled tabletop display. The task was to organize this information into groups and then annotating them to further identify the categories of data. In the specific example, a selection of botanic images (Fig. 2(a)) had to be grouped by species or genus. The images were put into storage bins [4] according to the classification. The user could move the images by directly touching them with the finger or pen with integrated RNT [3] capabilities. Two users can work on this or or similar tasks at the same time. They can toss images to each other to pass information on for the other person to look at. Hand-written Sticky Notes (Fig. 2(b)) can be created by each person to externalize their interpretation and identification progress of the data. Each person, therefore, can label their own categorizations to allow better discussion and sharing of data interpretation. Notes can be written onto large Sticky Notes due to the limited input resolution as noted above and then scaled down and put into the respective place in the information display to serve as annotations for the created groups (Fig. 2(c)).

Further application domains include the interactive creation of drafts for layout designs. Examples include layouts for print media where groups iteratively design and refine the arrangement of page elements with the Sticky notes being used to represent textual elements such as headlines or text blocks (Fig. 3).

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References

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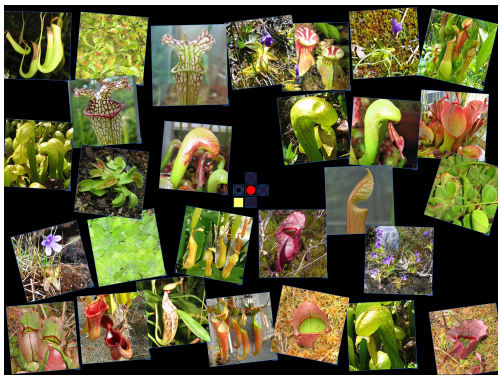
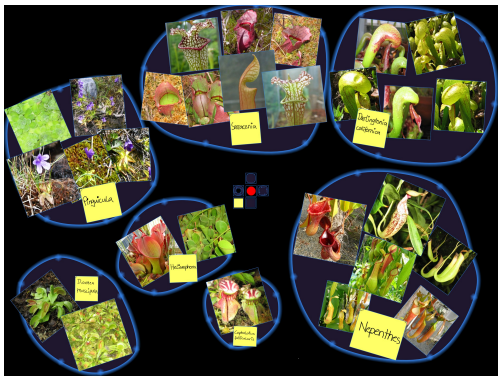


(a) Information to be organized.

(b) Organized objects and annotation writing.



(c) Data is organized and annotated.

Figure 2: Case study: organizing and annotating information.

Figure 3: Other application domains: Sticky Notes as headlines for a collage of images or page layout design drafts.