Collaborative Interaction on Large Tabletop Displays

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ABSTRACT

We present an integration of several interface metaphors and interface components that are designed to support users interacting on large tabletop displays. These techniques—RNT, Storage bins, Interface Currents, Sticky Boards, and Sticky Notes—help solving the orientation problem on horizontal displays, allow to organize content on the interface in a flexible manner, and provide users with ways to annotate their objects.

Keywords

Tabletop displays, interaction metaphors.

1. INTRODUCTION

In recent years, both industrial and academic researchers have become increasingly interested in large, high-resolution displays. These often come in the form of tabletops and walls displays and are starting to have multiple concurrent inputs in recognition that these types of displays are well suited for collaboration. We present an interface for a high-resolution tabletop display that takes advantage of the large working surface to offer support for collaborative activities such as storyboarding, designing, and developing layout strategies and organizing information such as photographs. This interface contains interface components designed to specially to support collaboration.

We have integrated several interface components into an interaction framework and will briefly outline the framework and then describe Rotate'N Translate, Storage Bins, Interface Currents and annotation capabilities.

2. THE INTERACTION FRAMEWORK

Because of the growing number of pixels that need to be filled, and of objects that people would like to use the problem of providing responsive interaction is increasing as the displays increase in size, resolution and number of simultaneous inputs. We are in the process of developing a new approach to address this issue based on a buffer approach [2] that allows to address the arising complexity issues using a spatial programming technique. Our implementations show that a speed gain of about one order of magnitude can be achieved allowing us to create interfaces that regain responsive interaction on large displays.

3. ROTATE'N TRANSLATE (RNT)

Based on our observational studies that showed that rotation and orientation of items in a horizontal interface plays three major roles during the course of tabletop collaboration: comprehension, coordination and communication, we designed a tabletop rotation mechanism, Rotate'N Translate [4], which provides integral control of rotation and translation using only a single touch-point for input. RNT was specifically developed to better support the communicative and comprehensive roles of orientation in order to more readily enable collaboration. RNT maps the two degrees of freedom of the input position to the three degrees of freedom of the position of the object combined with its orientation. This allows people to make communicative gestures that combine object orientation and translation into a single fluid gesture. For example, if one person would like to discuss a particular item with one of their team members, they can pass the object of interest in such a manner that its resulting orientation makes it possible for both people to be engaged. RNT also includes the toss capabilities. That is a passing gesture can end in a toss that will slide the object across the table surface, while re-orienting it.

4. STORAGE BINS

Storage bins [5] (see Fig. 1(a)) as manifested in this interface are mobile, adjustable container widgets. They offer a lightweight interaction interface mechanism that supports information storage, organization, and sharing. Storage bins provide the capabilities of a container, allowing items to be added or removed as a group or individually. They are resizable and reshapable and, thus, easily accommodate varying amounts of stored items. Storage bins can be moved to any location in the tabletop and, in fact, are RNT and toss enabled.

Using Storage bins in the interface to store and organize objects allows users to efficiently manage the available resources. They reflect personal, group, and storage territories that are established by people as they use the table. Since storage bins are mobile they also enable flexible and simple adjustment of these territories during use. People can use storage bins to bring items into and move them out of the

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(a) Storrage Bins and Sticky Boards. (b) Interface Currents. (c) Sticky Notes.

Figure 1: Interface components integrated into our system.

current focus of interaction. Storage bins can also be collapsed, allowing users to manage the available space more efficiently.

5. INTERFACE CURRENTS

In order to support management, organization, and sharing of a larger amount of objects on a tabletop, we introduced Interface Currents [1]. An Interface Current is characterized by flexible boundaries and a controllable, on-going flow. Objects that are added to the current are controlled in position, size, and orientation by the Interface Current such that the objects flow smoothly within the current. Users can control Interface Currents by changing their shape, size, and position as well as the direction and speed of the flow. The flow, however, is only indicated through the movement of the contained objects and, thus, does not otherwise distract the users.

6. STICKY BOARDS

As an additional means to organize and arrange objects on the tabletop interface that allows more control over each object's properties we created Sticky Boards. These are rectangular containers that can hold objects without restricting the modification of the objects' size, motion, or orientation (see Fig. 1(a)). The only property that is controlled by a Sticky Board is the objects' position. This enables users to arrange objects on this board much like on a bulletin board (see Fig. 1(c)). These arrangements can then be passed on the table from one user to the next while maintaining this organization. This is very useful, for example, for supporting group design tasks, e. g., for print media.

7. ANNOTATION CAPABILITIES

Text input is essential for collaborative interaction on digital tabletop displays but using separate input devices such as physical keyboards breaks the continuity of interaction. Virtual keyboards on the screen do also not provide a good solution to this problem because they cover a lot of screen space and since they lack the haptic feedback of regular ones. Therefore, we use virtual Sticky Notes [3] (see Fig. 1(c)) that can be interactively written and drawn upon and that otherwise behave like all other objects on the interface.

Sticky Notes can be used for annotation of information as well as to represent textual or graphical elements of objects created on the interface. Their hand-written character supports the creative tasks performed in the collaborative situations that we are supporting with tabletop interaction. In addition, they also allow an easy identification of the text's or annotation's author through the handwriting.

8. CONCLUSION

Integrating RNT with Storage Bins, Interface Currents, and Sticky Boards as well as the capabilities for annotation using our tabletop interaction framework provides one step towards a possible tabletop interface. We will continue to explore extensions and new possibilities for interface tabletop components.

9. REFERENCES

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