On-demand, In-place Help for Mixed Reality Environments

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ABSTRACT

In many help systems, users are either distracted with a constant barrage of help or have to stop working on the task at hand and explicitly search for help. In this paper, we propose intuitive methods to present on-demand, in-place help in mixed reality interfaces. In these interfaces, users interact with virtual objects that are superimposed on the real world by manipulating physical cards. We describe *Tiles*, a prototype application for designing aircraft instrument panels, from which our work on help systems grew. In Tiles, *Tangible Bubble Help* is used, in which users manipulate special 'help' cards in combination with data cards to invoke detailed help. Tangible Bubble Help may be multi-modal, taking the form of text, audio, graphics, and animations. We also present *Tangible Tooltips*, a lightweight technique in which users control the amount of textual help by tilting data cards to different degrees. In both cases, users can seamlessly transition between performing the main task and acquiring help.

INTRODUCTION

Augmented or Mixed Reality (AR or MR) integrates computer-generated virtual information into the real physical environment [1]. Although several compelling MR systems have been demonstrated, many serve merely as information browsers, allowing users to see or hear virtual data embedded in the physical world. There has been little work done on designing effective interaction techniques, so systems generally provide few tools for the user to request or interact with the information [6].

Help systems have been one of the corner stones in desktop graphical user interfaces (GUIs) and are heavily replied upon by users. Granda et al. found that on-line help was the second most frequent source of guidance for users (asking other users was the first) [3]. Designing on-line help facilities is however, not a straightforward task. It has been shown that poorly designed help systems can actually decrease learnability and usability for novice users [4].

In designing our help system, we consider three main issues: when to provide help, as well as where and how. We challenge the prevailing assumption that users in MR environments want all virtual information visible all the time. In fact, our early experiments with MR interfaces [2] have convinced us that virtual data that is always visible can be distracting. In addition, help should be context sensitive, providing several levels of detail to lead the user through difficult tasks. Therefore in our MR work, we require that the help provided should be *on-demand* and *in-place*, i.e. help should be provided only by user request and without requiring the user to shift focus from the main task.

This paper is the first step toward designing effective interaction techniques for help in MR environments. We present two techniques – *Tangible Bubble Help* for detailed multimedia assistance and *Tangible Tooltips* for short textual reminders.

APPLICATION PLATFORM: *TILES*

Although our help techniques are broadly applicable, we implement them within our *Tiles* system, built for rapid prototyping and evaluation of aircraft instrument panels [5]. Tiles is a joint research initiative carried out with support from DaimlerChrysler AG and DASA/EADS Airbus.

In our interface, we allow users to quickly layout and rearrange a set of virtual aircraft instruments on a board simulating an airplane cockpit. Users each wear a lightweight HMD with an attached camera. They interact with virtual objects (aircraft instruments) by manipulating physical data cards marked with square tracking patterns (Figure 1a). Our computer vision system identifies these patterns in the video stream and determines their 3D positions and orientations relative to the head-mounted camera. Virtual objects are then rendered on top of the physical cards. Using various interaction techniques, users are able to easily and quickly evaluate the layout, rearrange instruments as necessary, add new instruments or remove those that are not needed.

TANGIBLE BUBBLE HELP

In tangible bubble-help, users are provided with dedicated 'help' cards designated with both distinct physical 2D tracking patterns and 3D virtual help widgets. To receive help on any other virtual object, users simply place the help card next to the data card on which they require help. In simplest case, this triggers explanatory text that appears within a bubble next to the icon (Figure 1b).

Initially this function was used for the instrument designer to leave short annotations on instruments or to provide help on control cards of the Tiles interface, e.g. the trashcan/delete card. However, we found multimedia help, such as audio annotations or 3D animations, to be particularly effective. We designed several help cards that bring up different kinds of help with different levels of detail. While one help card brings up textual annotations, another animates the instruments. A third card provides users with a 3D arrow that allows them to probe at different parts of the virtual or real objects in question, bringing up even more detailed help on

Figure 1: (a) Physical manipulation of help and data cards; (b) User view: Moving help card beside data card to acquire Tangible Bubble Help; (c) User view: Tilting physical card to attain Tangible Tooltips on virtual instrument.

component pieces. Although we have mainly used the bubble help techniques for providing help on virtual objects, it can just as easily be used for physical objects. For example, a real aircraft part that is marked with tracking patterns can be augmented with different levels of user help using the tangible bubble help technique.

TANGIBLE TOOLTIPS

Users do not always need extensive help. In some cases, all they need are short reminders, or tips, on the functionality of particular interface controllers. Help systems for this purpose have been implemented in other interfaces. In GUIs, for instance, briefly placing the cursor over a region may bring up a Tooltip – a concise description of the interface control. Such help techniques must blend seamlessly into the working process without requiring the use of special purpose tools.

Using the Tangible Tooltips technique, the user triggers the display of short descriptive phrases associated with each virtual object by bringing corresponding data cards into their working space and tilting them more than 30 degrees away from the body (Figure 1c). Other researchers have shown that tilting may be used as an interface parameter [7]. In the Tiles application this was typically used to display the name of the instrument, perhaps with the date of design. The working space is defined as the area less than an arms-length away from the user's body, so as to eliminate unsolicited help on cards with which the user is not interacting. We are experimenting with displaying different amounts of help depending on the degree of tilt.

Early observations showed that Tangible Tooltips were surprisingly intuitive because users tend to hold cards perpendicular to the camera when interacting with them. Tilting the data card also borrows from our interaction with everyday physical objects, e.g. to find out information about the contents of a package, we turn it around to look at the label on the back. Initial testing, however, suggested that users occasionally tilt the cards for short periods of time while they perform other tasks, such as evaluating their layout from different angles, or looking down to pick them up. Because tooltips rising out of the card at this point are distracting, we implement a small delay (~1 second) before the help message is rendered. This is not unlike GUI Tooltips systems in which the cursor must linger over a region for some time before help is shown.

DISCUSSION AND FUTURE WORK

The Tiles system and help techniques were demonstrated at IEEE/ACM ISAR2000. About seventy users, including many AR researchers, tried the system. With simple instructions, users were able to simulate the design process, laying out and rearranging the instruments on the board and acquiring help when necessary. DaimlerChrysler AG engineers are now evaluating the Tiles interface concept for feasibility in industrial applications. We are currently looking at conducting formal user studies to evaluate the MR help systems and improve the design of interaction techniques.

CONCLUSION

We have described interaction techniques for providing MR users with on-demand, in-place multi-modal help with multiple levels of detail. Although design of the help systems has been an important area of research in traditional user interfaces we are not aware of prior attempts to design help interfaces for AR and MR environments. We presented two help techniques, *Tangible Bubble Help* and *Tangible Tooltips*, that we implemented within the *Tiles* MR environment. These techniques provide users with simple tools to acquire help without shifting focus away from the main task.

REFERENCES

1. Azuma, R. (1997). A Survey of Augmented Reality. *Presence: Teleoperators and Virtual Environments* 6, August 1997, pp. 355-385.
2. Billighurst, M., Poupyrev, I., Kato, H., May, R. (2000). Mixing Realities in Shared Space: An Augmented Reality Interface for Collaborative Computing. *ICME 2000*, pp. 1641-1644.
3. Granda, R., Halstead-Nussloch, T., Winters, J. (1990). The perceived usefulness of computer information sources: A field study, *SIGCHI Bulletin*, 21(4), pp. 35-43.
4. Neerinex, M., DeGreef, P. (1993). How to aid non-experts. *InterCHI '93*, pp. 165-170.
5. Poupyrev, I., Tan, D.S., Billinghurst, M., Kato, H., Regenbrecht, H., Tetsutani, N. (2001). Tiles: A Mixed Reality Authoring Interface. *INTERACT 2001*.
6. Rekimoto, J., Ayatsuka, Y., Hayashi, K. (1998). Augment-able Reality: Situated Communication through Digital and Physical Spaces, *IEEE ISWC '98*, pp. 68-75.
7. Rekimoto, J. (1996). Tilting Operations for Small Screen Interfaces, *UIST '96*, pp. 167-168.