

Interacting with a Computer Augmented Environment

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Abstract: In Sony CSL Interaction Laboratory, we are investigating future human-computer interaction technologies that augment real world environments. In such an environment, as we can combine many physical tools to perform a task in a real world, we consider that it should be possible to dynamically combine multiple digital devices. We should also be able to use our trained physical skills, as well as logical skills, to interact with an environment. In this presentation I will introduce several examples of new user interface technologies.

1 INTRODUCTION

As Mark Weiser (Weiser 1991) and many other visionaries foresaw, our physical space is becoming filled with a number of digital devices. Some of them will be invisible (i.e., embedded in the environment); others will remain visible like today's computers. In a meeting room, for example, participants may use notebook PCs while a presenter uses a digital whiteboard, and an embedded digital camera may track the presenters' position. To investigate a computer augmented environment, we are developing and evaluating an experimental space as shown in Figure 1.

Unlike traditional desktop computing, in such an environment people often use more than one computer or dynamically change computing styles. However, it is not so easy to combine multiple computers and devices without UI enhancement. Using traditional GUIs, we are forced to manage unintuitive and indirect concepts such as "machine IP addresses," and "file names", even if target devices are physically placed in front of us.



Figure 1 The Interaction Laboratory's Experimental Augmented Space

2 INTERACTION TECHNIQUES FOR COMPUTER AUGMENTED ENVIRONMENTS

To deal with these problems, we are investigating several interaction techniques that make augmented environments easier for people.

Pick-and-Drop (Rekimoto 1997) is our initial attempt at designing multiple computer user interfaces, focusing on data transfer problems. Like the commonly used drag-and-drop, pick-and-drop is a pen-based direct manipulation technique for transferring digital data such as icons on a computer screen. It allows a user to physically pick up a digital object from one computer, carry it through real space, and drop it in a different place - typically a different computer screen (Figure 2). Just like chopsticks are used for moving a piece of food from one dish to another, pick-and-drop provides a method whereby a user can physically carry data as if it were a real object.



Figure 2 Pick-and-Drop: Picking-up and Transferring Digital Information between Computers

3 AUGMENTED SURFACES

The large display surface of the digital whiteboard makes conventional GUI design ineffective. For example, the placement of menu bars or tool bars becomes a problem because they might be out-of-reach of users. The single-thread features of current GUI design also prohibits parallel activities among collaborators.

Instead of using a single display surface, we have built a digital whiteboard system using a palm-sized computer as a palette (Rekimoto 1998). A user can select a colour and brush type for the pen by tapping the control panel on the palm-sized computer (Figure 3). This metaphor is obtained from working style of an oil painter using a canvas and a palette. This interaction style is advantageous for drawing on a large display, because users do not have to click on a tool palette on the whiteboard, which might be out of reach. The user can also transfer digital data between any participating computers using pick-and-drop operations.



Figure 3 A Digital Whiteboard System with Hand-held Tablets

We have also developed a computer-augmented environment consisting of a digital table and a digital wall (Rekimoto and Saitoh 1999) (Figure 4). When a user sits at the table and puts his/her portable computer on the table, a video camera mounted above the table finds its attached visual marker and identifies the owner of the computer. Then the user can use the table surface as an extended workspace for the notebook computer. The user can freely transfer data between table and other computers with a simple direct manipulation operation.

Our initial table system uses projector mounted above the table and thus it is not a portable system. Interaction Lab designers, Eduardo Sciammarella and Haruo Oba, invented a new projection architecture and developed the MediaPond system (Figure 5). Using a conic-mirror, it integrates all the necessary devices into a single portable unit, making easier to set up computer augmented surfaces.

Digital Design



Figure 4 A Collaborative Environment with Digital Table and Wall



Figure 5 MediaPond: An Integrated Projector/ Sensor Unit for Augmenting a Table

4 CONCLUSION

Our primary goal of these systems is to extend the concept of direct manipulation into physical environments. More specifically, we believe that interaction techniques must overcome the boundaries between devices, and that environments must accommodate to the dynamic addition of new devices.

REFERENCES

Rekimoto, J. 1997. Pick-and-Drop: A Direct Manipulation Technique for Multiple Computer Environments. *Proceedings of UIST '97*, 31-39.

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- Rekimoto, J. 1998. A Multiple-device Approach for Supporting Whiteboard-based Interactions. *Proceedings of ACM CHI '98*, 344-351.
- Rekimoto, J and S. Masanori. 1999. Augmented Surfaces: A Spatially Continuous Workspace for Hybrid Computing Environments. *Proceedings of ACM CHI '99*, 378-385.
- Weiser, M. 1991. The Computer for the Twenty-first Century. *Scientific American*, 94-104.