Chapter 1
An Intuitive Interface for Interactively Pairing Multiple Mobile Devices:
Dynamic Reconfiguration of Multiple Screens and a Variety of Content Designs

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ABSTRACT

We designed an intuitive user interface to connect multiple mobile devices over a network and relate the applications running on them. We proposed a pinching gesture for making a connection between two devices, which is realized by swiping the touch screens of the two annexed mobile devices as if to stitch them together. We believe that this user interface can create new user experiences for multiple-screen usage, especially by designing the application content to react instantly to the connection and disconnection triggered by the gesture. We expect this interface to fulfill a great potential in inspiring application designers to conceive various ideas, particularly suited for visually fascinating content that takes advantage of the dynamic reconfigurable multi-display feature. To demonstrate the potential, we produced some prototype applications. In this article, we explain the idea and details of the interface mechanism, and introduce the design of the sample applications.

INTRODUCTION

Through our attempts of using a multi-display environment for interactive content, we have particularly focused to realization of a system that allows to change its screen layout flexibly and easily. Our objective was to pursue multi-display usage that can enrich representation of digital content. Herein, we designed and implemented a reconfigurable multi-display system with commodity mobile devices, and used a pinching gesture as the intuitive interface for establishing network connection between the different devices.

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A multi-display environment is generally used for offering extremely large and high-resolution virtual screens (Ni et al., 2006; Li et al., 2000). The display composition for such a system is generally static and permanent. The main application domains that use such environments are scientific visualization and virtual reality. If interactive applications (such as media artwork) are run on a multi-display system, the larger composite screen would create a greater impact on an audience than a normal single display would do. However, if multi-display is constructed only to form a single large virtual screen, no different user experience would be provided other than the impact given by the screen size.

In pursuing the potential of multi-displays as a platform for interactive content, we decided to seek a way in which the display layout can be reconfigured interactively. Our concept of a "reconfigurable" system is not restricted to the aspect of changing the screen layouts. We also want to add and remove devices freely to and from the multi-display configuration at any time. We believe that more interesting representations are possible by making a change in screen layout itself trigger an application response.

We do not like to use specifically designed devices because we want our technology to be commonly available. Therefore, we chose mobile devices such as smartphones and tablet PCs as the hardware platform. These are ideal for our approach, because of their mobility and high-resolution displays. It is also helpful that many people now own such devices. We also wanted to avoid mechanisms that would only work at previously prepared places, or require extra sensing devices or manual network configuration. The latter points would be a significant obstacle to the ideal of dynamic interaction. Many different approaches and interfaces can be designed for realizing dynamically reconfigurable multi-screen systems, but we believe that a great difference exists between one that merely achieves the function and one that provides a new user experience. The latter cannot be realized merely by designing an interface that is simple and intuitive. Such an interface must be organically integrated into usage scenarios and applications. We chose to employ a pinching gesture to establish a network connection between two devices because the gesture would imply the intention of connecting two things. The gesture is performed by holding a forefinger and thumb on each of two annexed screens, and moving the fingers together in a pinching motion, as though stitching the screens together. To break the connection, we chose a shaking or tilting action to accomplish the task. With these gestures for forming a multi-display environment, we designed "Pinch"-able applications, which react instantly without further prompting other than connecting or disconnecting of devices. This arrangement enables a user to have the illusion that his or her hand has come to possess a magical power that can connect digital content.

We introduce in this article the applications we created to demonstrate the technology's potential for producing a variety of content design and new user experiences. We designed them with special emphasis on dynamic interactions.

DYNAMICALLY RECONFIGURABLE SCREENS

Displaying visual content on a multi-display can strengthen the impression it makes, by offering an extremely large screen. However, in terms of the audience's experiences, it would not be much different from the case in which the content is played on a single display, as long as the application of multi-display is restricted to providing a single large screen. Having a different display formation such as the CAVE system may offer a different user experience, but each different display arrangement provides only one alternative. What we desire here is to add more flexible and interactive features to the usage of multiple displays.