Ubiquitous Graphics

Johan Sanneblad[*] and Lars Erik Holmquist[†]
Future Applications Lab, Viktoria Institute

1 Introduction

Ubiquitous Graphics addresses the problem of interacting with very large computer graphics images. It uses a combination of mobile and stationary displays to show both overview and detail. The main image is displayed using a projector or other large traditional display. To access details, the user holds a mobile device in front of the stationary display (c.f. Figure 1). Using ultrasonic tracking the smaller display is aligned with the overview, giving access to a corresponding portion of the image in higher resolution. Alternatively the system provides "magic lens" functionality that can show additional information.

Users can interact directly with the image, by adding free-form annotations and pre-defined graphical objects. Several devices can be connected to the system at the same time, allowing for collaborative applications. Changes are propagated across all devices connected to the system, so that when one user makes an annotation it immediately become visible on all other displays, including the overview. Users can either add annotations in-place by holding up their device to a desired portion of the overview image and scribbling on the surface of their own device, or they can "tear off" an area by holding up the display to the required portion, then remove it and work away from the large display. As an additional form of navigation, standard panning and zooming is provided through a GUI on the mobile device.

Ubiquitous Graphics offers new functionality compared to related systems (such as the Focus Plus Context Screen [1] and Peephole Displays [3]), in that it combines a peephole display to access a shared workspace, a focus plus context display and a wireless 2D tracking system (based on our Total Recall prototype [2]), all in one system.

2 Exhibition

At SIGGRAPH we will allow visitors to interact with Ubiquitous Graphics using two tablet PCs and an IPAQ handheld computer. We will use two scenarios to demonstrate the system. In the first scenario, the system is used to view and annotate the details of a large projected map; in the second, it is used to see a "before-after" view of a modified image.

In the first scenario a large projection screen shows the map of a city, with major graphical features clearly visible. However, the resolution of a projection this size does not allow any details to be seen, such as smaller roads or names of local areas. With Ubiquitous Graphics, the user holds up a tablet PC in front of the projected image. A fine network of roads now becomes visible, as well as many additional names and other features. The coast of a lake which appears smooth in the overview image becomes much more ragged with small creeks visible in fine detail. Through a magic lens effect additional information can also be made visible: for instance, a map of the electricity system, or indications of speed limits or other points of interest that are not shown on the overview map.

In the second scenario, the user is looking at a large projected image of a famous painting, Leonardo da Vinci's The Last Supper. This painting was subject to a major renovation work

---
[*] e-mail: johans@viktoria.se
[†] e-mail: leh@viktoria.se

Figure 1: A user holds up a tablet PC in front of a large projected image to view details and interact with the shared workspace.

between 1979 and 1999, and many details were changed – some rather controversially. The projected display shows the familiar version, before restoration. At this size, a projection is great for seeing the scale and overall features of a large image; however, it is hard to get any sense of fine details or brushwork. By holding a portable screen to a portion of the projection screen, the user can reveal the painting as it looks today, after restoration. The renovated version is shown in the maximum resolution allowed by the handheld device; on a tablet PC, this is enough to see very fine detail and examine the restoration work carefully. The user can directly compare the new and old version by moving the screen around the projected image.

3 Conclusion

We have introduced Ubiquitous Graphics, a system to interact with large computer images using a combination of stationary and mobile displays. The main contribution of the project is the fluid combination of many different types of displays to interact with a shared workspace. Also, the possibility to add annotations and animated objects that are shared over all devices and anchored in a certain position on a larger projected image is novel. While several other systems allow users to simultaneously share the same work area, our system has the advantage of letting users add and access annotations directly and physically on a large graphics image. This makes it much easier to work collaboratively on a large image, for instance to work out changes in a plan or explore an interesting artwork.

1. Baudisch, P., Good, N. and Stewart, P. Focus Plus Context Screens: Combining Display Technology with Visualization Techniques. In *Proceedings of UIST 2001*, Orlando, USA, pp. 31-40.

2. Holmquist, L.E., Sanneblad, J. and Gaye, L. Total Recall: In-place Viewing of Captured Whiteboard Annotations. In *Extended Abstracts of CHI 2003*, Ft Lauderdale, USA.

3. Yee, K.-P. Peephole Displays: Pen Interaction on Spatially Aware Handheld Computers. In *Proceedings of CHI 2003*, Ft. Lauderdale, USA.