Chapter 9
Personal Touch:
A Viewing-Angle-Compensated Multi-Layer Touch Display

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ABSTRACT

Large format touch screens have become an important means of interaction for collaborative and shared environments. This type of display is particularly useful for public information display in museums and similar contexts. Similarly augmented reality displays have become popular in this context. Both systems have benefits and drawbacks. Personal Touch is an augmented-reality display system combining real objects with superimposed interactive graphics. With increasing display sizes and users moving in front of the display user tracking and viewing angle compensation for the interactive display become challenging. Personal Touch presents an approach combining IR optical tracking for gesture recognition and camera-based face recognition for the acquisition of viewing axis information. Combining both techniques we can create a reactive augmented-reality display establishing a personalized viewing and interaction context for users of different statue moving in front of a real object.

INTRODUCTION

The use of large format touch screens for public locations such as museums or libraries has become widely popular. A recent survey (Ardito, Buono, Costabile, & Desolda, 2015) indicates that the common usage of this type of display has transformed established concepts of human computer interaction and shaped the expectations about interactive possibilities in public and semi-public spaces. Research about museum visitors has shown that young visitors prefer museum collections to be displayed in innovative ways. Having grown up with interactive multi-touch technologies young visitors respond positively to interactive information displays presented on touch screens (Ting, Lim, & Sharji, 2013). While maybe particularly popular among younger users, touch screen interaction is now widespread and easy to use for a wide range of age groups (Montague, Hanson, & Cobley, 2012). Traditionally museum displays have been focusing on objects from their collection in combination with introductory texts and explanations.

But as textual and visual information going beyond the existing physical evidence in form of collection objects exists, for example various forms of information visualization, interactive screens have become more prevalent. (Hinrichs, Schmidt, & Carpendale, 2008) Those displays are often dynamic interactive presentations in addition and in support of collection objects. The hardware of choice to realize these presentations are large format touch screens. Since the mid 2000s large touch-screen use has been more frequent due to more powerful and more economic technology (Ardito et al., 2015).

For use in shared spaces large format touch-screens provide several benefits that make them specifically suitable for environments like museum or library displays. The most prominent among these are the visibility and attraction of large dynamic visualizations for museum visitors walking through the exhibition space. Compared to static printed text or small displays the ability to grab attention and direct the visitor's gaze is significantly stronger. Outside of the museum, for example in a shared office, the salience of the display is often less important. Large interactive displays also promote activity and social awareness among its users. (2015) The conduciveness for communicative behavior and collaboration is generally one of the core benefits of this type of display system. In particular in complex tasks the opportunity for co-located problem solving can be highly beneficial (Isenberg et al., 2012). Again the museum environment differs from other environments as it is less focused on collaborative solving of complex tasks rather than communication among visitors to foster learning and engagement. The increased screen size and the possibility to collaboratively interact in a shared environment have been shown to provide benefits for sense-making (Andrews, Endert, & North, 2010) and learning (Reski, Nordmark, & Milrad, 2014).

Another display technology that has become very popular in the museum environment is the augmented reality (AR) display. In particular in science and natural history museums this form of display has gained such popularity that it is sometimes referred to as a hype ("British Museum - Augmented Reality: Beyond the Hype," n.d.). The popularity stems from the fact that it can simulate prior states of a real physical collection object. A popular example is the dinosaur skeleton, which can be seen as a complete dinosaur through an augmented reality display (Augmented Reality Livens Up Museums | Innovation | Smithsonian n.d.). (Barry, Thomas, Debenham, & Trout, 2012) Augmented reality displays blend a representation of a real context, for example a museum object, with a computer generated information layer. Both layers are displayed such that they are correctly superimposed. The additional information can be of various kinds, such as the virtual models of dinosaurs or simply additional textual information pertaining to an object. We can distinguish applications using a camera generated video image to represent the real context and those that use optical see-through techniques to show the real object (Normand, Servières, & Moreau, 2012).

One of the important issues for both techniques, the touch-screen as well as the augmented reality system (of course the same applies to the traditional static text panel), is how the relationship between the additional information and the real object is established. The touch-screen is often used as a self-contained unit placed in proximity to the objects it refers to. If close relationships are established it is mostly through the display of visual representations of the objects nearby that the information refers to. Screen and objects have very different viewing conditions and are rather in competition than in support of each other. Augmented reality systems deliver a much closer relationship between object and additional information. By superimposing both object and additional information users can see directly how they relate to each other. For this reason the alignment between the two is a distinguishing quality factor (Liestol & Morrison, 2013)./ The earliest way of establishing the connection between real and virtual was through markers, coded visual symbols such as QR-codes, that can be read by the AR-device

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