Chapter 11
Design of the PromoPad: An Automated Augmented-Reality Shopping Assistant

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ABSTRACT

Augmented-reality technologies as a new way of human-computer interaction make possible real-time modification of our perception of reality without active user interference. This article introduces the prototype of an augmented-reality shopping-assistant device, the PromoPad, based on a handheld tablet PC allowing see-through vision with augmentations. While this new interaction utilizing augmented reality that places products into contextual settings can enhance shopping experience and suggest complementary products, it also has challenges and issues when used in a public environment such as a store setting. This article discusses the design and implementation of the PromoPad, and addresses the issues and possible solutions. The concept of dynamic contextualization is further investigated in this setting with a list of possible context modifications and their relation to advertising and the psychology of consumer purchasing.
INTRODUCTION

This article presents the design of the PromoPad, an augmented-reality shopping assistant that provides a new way of human-computer interaction in a new setting. Augmented-reality technologies have been enhancing people’s perception interaction with the real world using computer-generated virtual objects. Furthermore, augmented-reality technologies change the way that people interact with the computer and the real world. By the new way of human-computer interactions, users interact and manipulate with the real world and real objects with the aid of computers without the users’ active operation of a keyboard or mouse. Considerable amount of research work has been conducted in the area of augmented reality and human-computer interaction in various application domains (Mackay, 1996; Rauterberg, Mauch, & Stebler, 1996; Rekimoto & Nagao, 1995). The shopping environment, however, poses more challenges not yet well explored. First, a friendly user interface and negligible user interference are essential characteristics for such a system. Second, the amount of information that can be delivered to the user is vast so that how to effectively provide the most relevant information to the user without cluttering his or her view becomes a major concern. Cluttering the display can significantly degrade the quality and performance of the tasks that the user and the PromoPad are performing (Rosenholtz, Li, Mansfield, & Jin, 2005). Third, the users of the system come from different backgrounds and possess difference skill levels. They might not use the system like our laboratory staff; they might use and move the system differently as they move around. Hence, robustness and stability are other key points that lead to the success of this design. These challenges are deliberated throughout the design and implementation of the system and will be addressed in detail in this article.

The application of augmented reality in store settings is promising. Given the fact that 70% of purchase decisions are made in the store (Armata, 1996) and retail grocery shopping in the United States alone is a $450 billion business (U. S. Census Bureau, 2001), computer-aided shopping assistants can be an important tool that can affect both planned and potential purchase decisions. Recent research in advertising shows that a virtual experience simulating 3-D product visualization results in more product knowledge, better brand attitude, and elevated purchase intention relative to traditional advertising (Li, Daugherty, & Biocca, 2002). This work draws on technical capabilities in the augmented-reality community in combination with theoretical concepts from consumer responses to advertising in order to demonstrate and evaluate the concept of dynamic contextualization.

The PromoPad system, built on the concept of dynamic contextualization (Zhu, Owen, Li, & Lee, 2004), uses a tablet PC (personal computer) as a see-through display (Milgram & Kishino, 1994) to provide personalized assistant information to an individual customer. Using dynamic contextualization, the PromoPad not only actively discovers and takes advantage of the context of the user and the environment at a single point (Chen & Kotz, 2000), but also modifies the context to allow retailers to direct users’ interests in real time using augmented-reality technologies. These discoveries and modifications of the context are means to improve human-computer interaction and enrich user experience. Augmented reality, as distinct from virtual reality, is the modification of the perception of reality. In this system, the tablet PC is equipped with a small camera on its back, and the display presents the camera image as if the tablet were transparent. Because the image is processed, augmentation graphics can be used to add to the visible context, and erasures or occlusions can be used to remove context by diminishments; all of these operations occur in real time (Azuma, 1997). Several empirical studies on the effectiveness of augmented-reality technologies in terms of human-computer interaction provide sufficient evidence that augmented-reality sys-