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Data Souvenirs: Environmental psychology and reflective design

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Abstract

The physical form of technology and its relationship to the surrounding environment is an important factor in design; we argue that this is especially true in the design of reflective technology. We suggest environmental psychology theory as a tool for understanding this relationship and use it to propose design guidelines for tangible reflective technologies. As an example, we apply these guidelines to the design of domestic technology, inspiring the creation of *Data Souvenirs*, a set of hardware sketches we have built that combine technology with the physical form of books. Additionally, we reflect on our own design process, discussing how the combination of environmental psychology theory and hardware design sketches can motivate novel tangible designs.

Keywords: Tangible interfaces; Design; Personal reflection; Environmental psychology

1. Introduction

In both the academic literature and in popular culture, the importance of personal reflection, or stepping back and thinking about one's life, is well established. Schön (1983) discusses how reflection can help professional practitioners be more effective, and numerous self-help books espouse the importance of reflecting on one's position in life—spiritually, practically, and emotionally. Various technologies support these practices, including research prototypes (Gaver et al., 2007; Romero and Mateas, 2005; Morris, 2005) and commercial products for planning (such as Microsoft OneNote) or casual reflection (such as photo viewing and journaling software). However, some existing technologies can be counter-productive to the task of reflection. For example, devices like Blackberries and laptops provide an always-on connection to e-mail, work, and the Internet, potentially drawing one away from reflective activities. Additionally, while the multi-tasking nature of devices like laptops and desktops is often viewed as a positive attribute, they can also present distractions (Fogarty et al., 2005), limiting opportunities for extended reflection.

We are particularly interested in the relationship between reflection and the physical form of technology. In this paper, we highlight how work from environmental psychology, such as restorative environment theory (Kaplan and Kaplan, 1989), can help motivate new designs as interfaces become more tangible and closely connected to the physical environment. We suggest that these established theories are particularly useful tools in designing interfaces that fit into the evolving landscape of personal and domestic technologies, showing how new devices can help rather than hinder well-studied human behaviors such as personal reflection.

First, we introduce restorative environment theory and present design guidelines for reflective technology that are informed by restorative environment theory. As an example of their application, we use these guidelines to suggest the physical form books as reflective objects. We then describe the design and implementation of *Data Souvenirs*, one possible realization of this concept. Finally, we discuss how using Data Souvenirs as hardware sketches in

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combination with restorative environment theory helps to enrich the discussion of reflective technologies.

2. Related work

In considering reflective technologies, we chose to focus on the relationship between reflective technology and physical space. We present related work in each of these areas below.

2.1. Tangible reflective technology

The role of physical artifacts in helping to externalize identity and to aid in personal reflection has been studied by sociologists and anthropologists such as Csikszentmihalyi and Rochberg-Halton (1981) and McCracken (1991). These authors suggest that the artifacts in our environments help to define who we are; they are used to present our identity to others and to remind us of ideas or aspirations that are important to us. More specifically, a number of technologists have considered the role technological artifacts and *reflective design* can provide in supporting reflection (Norman, 2003; Sengers et al., 2005; Romero and Mateas, 2005). Sengers et al. (2005) define reflective design as "bringing unconscious aspects of experience to conscious awareness, ...making them available for conscious choice." While Sengers et al. consider reflection in the context of critical design theory, we have chosen to focus on technology to support the more everyday reflection of individuals reflecting on their daily lives, especially in the home. Specifically, we consider how the physical form of technology can provide appropriate support for this practice.

2.2. Existing reflective technologies

A number of designs have been proposed to support reflection through technology. We are interested in the relationship between technology and physical space in creating *reflective environments* (introduced in the next section). As a result, we have drawn inspiration primarily from technologies that interact with the physical environment through the use of sensors to collect data and of embedded or tangible displays to reflect that data back to users.

Several technologies use sensor data to record, interpret, and present ambiguous reflections of activities of individuals and social groups such as households (e.g., Gaver et al., 2007; Romero and Mateas, 2005). These electronic data streams provide the opportunity to present data about people's lives back to them, defamiliarizing everyday patterns and opening them up for reflection. Romero and Mateas (2005) argue that these *alien presences* can "open unusual viewpoints onto everyday human activity, create pleasure, and provide opportunities for contemplation and wonder." Other technologies focus on less ambiguous presentation of sensor data to allow more directed reflection about specific activities and memories. Examples include health feedback displays (Morris, 2005), the Digital Photo Browser (Hoven and Eggen, 2008), and MyLifeBits (Gemmell et al., 2006). Additionally, more mainstream, existing technologies support reflective processes using desktop computing applications. For example, online blogs support journaling, and software such as Microsoft OneNote supports directed reflection in the context of task planning.

MyLifeBits (Gemmell et al., 2006) is an attempt to capture images, videos, documents, and other sensor data over the span of a person's entire life. The system has the potential to generate a large amount of data, providing opportunities for reflection about a life's worth of activities. In some instances, the scope of the data makes creating a coherent set of views relevant to a single reflective task difficult, and the creators acknowledge the need to augment search with the automatic generation of stories and paths through the data (Gemmell et al., 2006). Unlike MyLifeBits, the *Digital Photo Browser* (Hoven and Eggen, 2008) contains a more limited set of photos and uses physical *souvenirs* as tokens to help cue the display of contextually relevant data. In both projects, the ability to capture and comment on images and videos of important people and experiences creates a potential for creating rich and meaningful connections with one's life data.

The Tableaux Machine (Romero and Mateas, 2005) is an ambient display positioned in a prominent location in the home. The system uses sensors to record the types and extent of social activity happening in different regions of the home and then creates an abstract, collage-like representation of that activity. The goal of the system is to encourage reflection about the social activities in the home. Unlike PC-based systems, the Tableaux Machine consists of a dedicated display that better supports using the system in a more reflective location. The large display is in some senses like a window, providing a different perspective onto the activity of the home. Unlike MyLifeBits, the Tableaux Machine provides abstract interpretations of the activity in a home. This ambiguity provides opportunity for reflection.

The Home Health Horoscope (Gaver et al., 2007) is a system that uses wireless sensors in the home to monitor activity and create a customized horoscope related to the activities in the home. The horoscope is printed on ticker-paper once per day via a dedicated printer in the kitchen. Users reported anticipating the new horoscope each day, and the regular, daily updates created a unique reflective location in the space/time of the home. Like the Tableaux Machine, the horoscopes are intentionally ambiguous. Users reported being fascinated with the system and trying to decipher how it worked.

The Health Feedback Display (Morris, 2005) is a system that monitors the level of social contact an elder has with friends and family, which it displays on an in-home display. The display has an overview mode that shows changing interactions with a "constellation" of friends as well as a more detailed chart showing historical interactions with each individual friend. The display is targeted toward a very specific task, reflection about levels of social contact, and it