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Sharing Digital Photographs in the Home Through Physical Memorabilia

by

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies for acceptance, a thesis entitled “Sharing Digital Photographs in the Home” submitted by Michael Nunes in partial fulfillment of the requirements for the degree of Master of Science.

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Abstract

Digital photography has largely replaced film for the average picture-taker. This technology allows people to easily take and store numerous photos, and gift-give photos to distributed friends and relatives over the internet. Yet, digital photos have lost many of the affordances for opportunistic face to face sharing within the home. In this thesis I investigate how new technologies can encourage digital photo sharing in the home through links to physical memorabilia.

First, I present the design and implementation of SOUVENIRS, a system that lets people link digital photo sets to physical memorabilia. These mementos trigger memories and serve as social instruments; a person can enrich their story-telling by moving the physical memento close to their large-format television screen, and the associated photos are immediately displayed. Next I present a study of families' practices of photo sharing and memento use, as well as their reactions to the Souvenirs design. Finally I re-examine our design premises and present a redesigned Souvenirs to better fit the real practices of photo and memento use in the home.

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Chapter 1

Introduction

Digital photography has largely replaced film for home use. While digital photos are easier to exchange with distributed friends and relatives over the internet, they lose affordances that facilitate opportunistic photo sharing and viewing when people are face to face in the home. In this thesis, I consider and investigate new technologies for photo sharing in the domestic environment. In particular, my goal is to investigate how systems can exploit links between digital photos and physical displays of souvenirs and mementos to encourage photo sharing. I begin this chapter by discussing the background motivating our work. I then describe related areas that form the context for our work. Finally, I state the problems and goals explored in this thesis, and give an overview of the remaining chapters.

1.1 Background

Digital photography has become increasingly popular. This is for good reason. It allows numerous photos to be taken and stored, while minimizing cost and hassle associated with film. People are free to take more photos - increasing their chance of getting a "good" photo, or taking playful "candid" shots. They can select and edit their favorites for printing. They are able to store photos without physical space restrictions. They can easily send photos to others via email or cell phones. Indeed, it is impossible to know just how many photos are taken with digital cameras per year [Norman, 2003].

While digital photography has revolutionized the way we take photos, we now must consider how technology affects how people use their digital photo collections. As noted by Norman:

"The technologies of digital picture transmission, printing, file sharing, and dis-

> *play are sufficiently complex and time-consuming as to prevent many people from saving, retrieving, and sharing the pictures they cherish.*" - [Norman, 2003]

Once taken, digital photos are tied to current computing systems that shape and potentially mar our ability to let photos "do what they do". That is, digital photos have altered - and sometimes even lost - many of the affordances that helped create and sustain the culture of how we take, use, and share print photos [Chalfen, 1987]. The challenge for systems designers is to provide affordances for the best practices that give print photos their value.

Of course, digital photos have their beneficial affordances, especially for encouraging distributed photo sharing. Tools for sharing photos over the web, via email, instant messangers (IM), social networking and photo sharing sites, as well as increasingly widespread availability of broadband internet in homes has made it easier than ever to gift give photos to distributed friends and relatives, or even various web communities.

Still, many people find that showing photos face to face in the home is the most enjoyable way to share photos. In spite of the wealth of photos stored digitally, many people rely primarily on printed photo albums for sharing in this way [Frohlich et al., 2002]. It is easy to see why. Consider the family shown in Figure 1.1 as an example. This family's print photo albums are located in their living room on a public shelf. Perhaps as part of a conversation any family member can easily take a photo album off the shelf and onto the living room table. They can easily sit around that album, pointing to photos and discussing them, and pass the album around for a closer look (1.1a). In contrast, their social use of digital photos is awkward. They now have to move to their father's home office, as the father (as the primary photo-taker) keeps the family photos on the computer located there (1.1b). This setting is not ideal for family viewing. There is only room for one person to sit in front of the computer desk; the others must stand, sometimes at an awkward angle or distance from the display. Additionally, they must wait while the computer is booted up, the proper user account is logged into, the desired photos are found, etc. The result is that digital photo sharing may be excessively unwieldy, or

awkward and not as engaging as print photo sharing, or may not happen (as opportunities may not present themselves).

To recap, the problem is that digital photos are currently difficult to share face to face in the home. The question then becomes: how can we design systems that encourage opportunities for face to face sharing in the home that are lost with digital photos? One possibility is to consider how the tangibility and physical location of other home artifacts (such as displayed souvenirs) create opportunities for sharing. Indeed, one solution could be to link digital photos with other home artifacts. Norman hinted at this potential solution in the juxtaposition of his discussions of souvenirs and photos as memory evoking objects [Norman, 2003]. Of photos he says:

> "*Personal photographs are mementos, reminders, and social instruments, allowing memories to be shared across time, place, and people.*" - [Norman, 2003]

Similarly, he discusses how souvenirs and mementos are valued for the memories they evoke:

> "*[A souvenir] is important only as a symbol, as a source of memory, of associations.*" - [Norman, 2003]

Indeed, displays of souvenirs or framed photos, such as in Figure 1.2, are common in many homes. This suggests that we might be able to exploit the connection between memory evoking objects by using physical souvenirs as a link to digital photos.

As will be discussed in this thesis, we want to see how a system designed around this link could situate and encourage digital photo sharing in the home. Our aim is not necessarily to supplant printed albums; we suspect the practice of printing and organizing subsets of favorites into print albums will continue to be desirable. However, given the wealth of digital photos being taken and stored, it is worthwhile to consider ways to make these photos available for sharing at home as well.

Figure 1.1: Sharing photos in the home a) with print albums, b) with digital pictures.

Figure 1.2: Souvenirs and photos displayed in the home.

1.2 Context

The context of this research is outlined in Figure 1.3. Broadly, our work contributes to *Computer Supported Cooperative Work* (CSCW), a branch of *Human-Computer Interaction* (HCI) that considers how computing systems can support group activity. We consider the design of systems to support face to face photo sharing in the home.

The widespread adoption of computers in the home has lead to an increasing interest in *Domestic Computing*. One result of this adoption is that artifacts and information encountered in everyday home life are increasingly becoming digital. Researchers have noted the affordances location provides for managing paper-based information in the home - e.g. providing cues as to who it is for, allowing them to act on it in a timely fashion, and maintaining an awareness of others' activity [Crabtree et al., 2003, Elliot et al., 2005]. In contrast, digital information is linked to personal computers, and can not take advantage of these affordances. Thus, *Domestic Computing* research often considers using *Ubiquitous Computing* to move digital artifacts "off the desktop" so they can be shared in the domestic environment.

Our specific focus is on photo sharing. Photos are an example of a domestic artifact that has

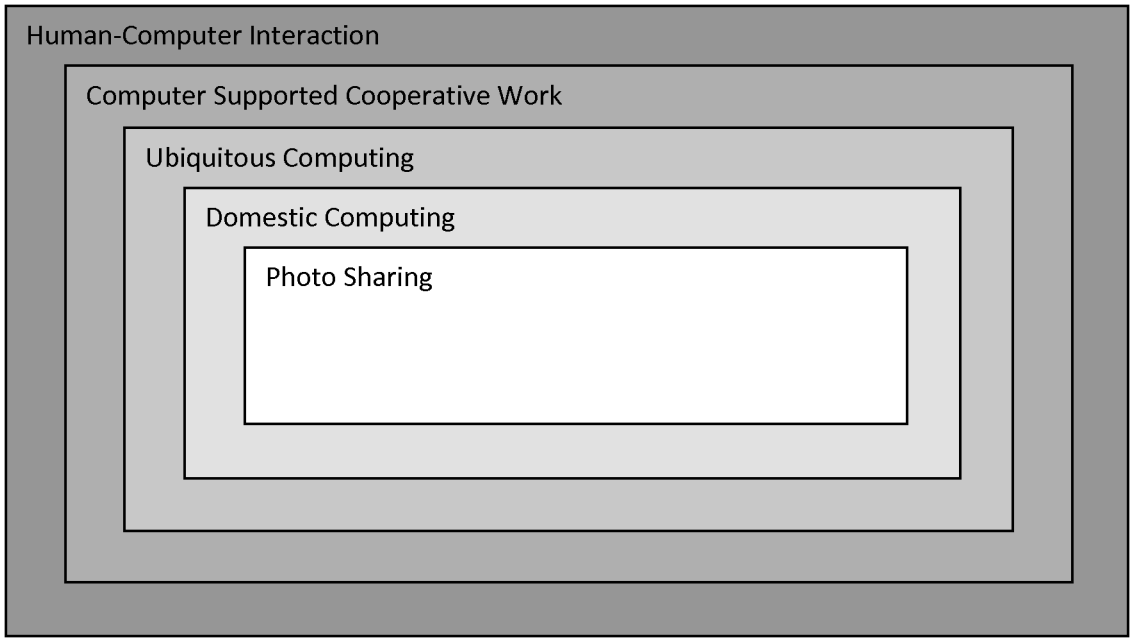


Figure 1.3: Research context.

transitioned from being a primarily paper-based media to a digital one. Researchers have studied storytelling over print photos [Frohlich et al., 2002, Crabtree et al., 2004], and considered how to improve affordances for sharing digital photos similarly [Lindley and Monk, 2006]. Our interest is in how digital photos can be situated in the home to encourage photo sharing. More generally (although not pursued in this thesis), it is also possible that the solutions discovered for digital photo sharing can be applied to other domestic digital artifacts, e.g., sharing of family digital videos, family documents, and so on.

1.3 Problems and Goals

This thesis addresses two main problems.

Problem 1: *We do not have a sufficient understanding of current domestic practices with print photos, with digital photos, and with souvenirs, to validate and critique our design idea.* We do not know how the various affordances - of the domestic setting, of print photos, and of

digital photos - currently influence photo sharing. Research in domestic computing suggests *physical location* of such artifacts is crucial to consumption of communication information. We speculate this creates opportunities for photo sharing, but are unclear on if or how it applies. We also speculate that physical memorabilia can link to digital photos as memory evoking objects, but do not know if and how they could be situated and shared in the home such that they could encourage opportunities for photo sharing.

Problem 2: *We do not know how a system for photo sharing that links physical memorabilia to digital photo sets can be designed to fit in with domestic practices.* Such a system will rely on its fit to routines for its adoption and success. It is unclear how and what souvenirs and mementos are kept such that they would be amenable for use with the system. The system must also accommodate for the ways families typically store and share their photos in the home. By situating the system within these practices, we improve its potential utility.

I address these problems with two corresponding goals.

Goal 1: *I will investigate domestic practices around photos and souvenirs, as well as families' reactions to our design idea.* I will conduct a study using in-home contextual interviews to build an understanding of these practices. First, I investigate how print and digital photo technologies affect photo sharing in the home. Next, I investigate how families typically collect, store, and share souvenirs in order to understand how these items are amenable for use with our system. Finally, I guage families' reactions to the system to consider how it might be adopted or improved *(Problem 1)*.

Goal 2: *I will build a prototype system to demonstrate our design idea, and revise that prototype to address challenges uncovered in the study.* I will build an initial prototype that will act as a baseline for demonstrating our design rationale - providing functionality to link physical souvenirs to digital photo sets for sharing. I will then consider issues challenging adoption of the system revealed through the study, and address these issues feature requirements. I will then build a revised prototype which exhibits these features. The revised prototype will not

be formally evaluated, but will serve as an embodiment of our design rationale and approach *(Problem 2)*.

1.4 Overview

This thesis is divided into nine chapters.

Chapter 2 provides a review of related work. The fundamental topics that inform our design and research approach - *tangible, ubiquitous, and domestic computing* are introduced with illustrative examples. Following this, I present prior work on photo sharing (focused on the home), as well as souvenirs and mementos. Within these topics I include cultural studies, as well as related system designs.

Chapter 3 presents the initial prototype design and implementation of SOUVENIRS, a system that links physical items to digital photos, and displays those photos as a slide show. I begin with a usage scenario that illustrates our design rationale. Following this, I give a detailed description of our design rationale. Finally, I discuss the implementation details of our prototype SOUVENIRS, which was built to further explore the idea.

Chapter 4 details the methodology of a study we conducted to validate our design ideas, build an understanding of domestic practices around photos and souvenirs, and elicit requirements for revising SOUVENIRS. The investigations in this study included three stages focusing on different topics: print and digital photos (*stage 1*), souvenirs and mementos (*stage 2*), and reactions to a video demonstration of SOUVENIRS (*stage 3*).

Chapter 5 presents the findings for *stage 1* - print and digital photos. I first compare print and digital photos with regards to how families organized them, where they were located in the home, and how they were accessible amongst family members, and for sharing with guests. I then discuss the methods families use to share photos, how these methods satisfy different motivations, and how print and digital technologies are amenable to these methods. Of particular interest is how tangible prints are preferred for showing photos in the home, so I

finish by presenting a detailed look at reasons for this.

Chapter 6 presents the findings for *stage 2* - souvenirs and mementos. In particular, I describe a classification of these items into four groups: *collectibles, personal accomplishment, worn/consumed,* and *trip output.* Based on the physical properties, typical locations in the home, and associated memories these classes exhibit, I discuss how they may be amenable as links to photos.

Chapter 7 presents the findings for *stage 3* - system demonstration. First I describe aspects of SOUVENIRS that families had positive reactions to. Then I discuss issues that families felt might challenge the adoption of SOUVENIRS.

Chapter 8 begins with a reflection on the study results by revisiting and tying them into our design rationale. I then describe several features for a revision of SOUVENIRS, which addresses challenges noted by families and aims to improve how the system fits in with observed domestic practices. Finally, I describe the revised SOUVENIRS prototype implementation, which exhibits these features.

Chapter 9 concludes by reflecting on how I achieved the research goals set out in this chapter, and offers considerations for future work.

Chapter 2

Related Work

This chapter will introduce the literature motivating and relating to our own research. I begin with overviews of tangible, ubiquitous, and domestic computing - these areas provide the foundations for our system design. I then discuss research in photo sharing. This includes studies of photo sharing culture, and systems for digital photo sharing in the face to face or domestic environment. Finally, I discuss research in souvenirs and mementos, similarly including cultural studies, and interactive systems that exploit such items.

2.1 Tangible Computing

Tangible computing is concerned with integrating digital information into our physical environment primarily by augmenting our physical artifacts with digital capabilities.

> *"[Tangible computing is] about awakening richly-afforded physical objects, instruments, surfaces, and spaces to computational mediation, borrowing perhaps more from the physical forms of the pre-computer age than the present.*"
> - [Ishii and Ullmer, 1997]

Traditional *Graphical User Interfaces* (GUI) provide graphical output on a flat screen, and are typically interacted with via keyboard and mouse. In contrast, *Tangible User Interfaces* (TUI) place more emphasis on both input and output to our digital world by exploiting and augmenting the everyday physical world. If well done, such interaction will leverage people's everyday life skills in interpreting and manipulating physical artifacts.

2.1.1 Tangible Bits

Ishii and Ullmer introduced the concept of *Tangible Bits* as a primary component of Tangible User Interfaces:

> *"Tangible Bits allows users to 'grasp and manipulate' bits in the center of users' attention by coupling the bits with everyday physical objects and architectural surfaces. Tangible Bits also enables users to be aware of background bits at the periphery of human perception using ambient display media such as light, sound, airflow, and water movement in an augmented space."* - [Ishii and Ullmer, 1997]

Their investigations had three key aspects for design:

1. Transforming previously inert surfaces in the environment (e.g. desks, walls, tables, windows, etc.) into interactive computing interfaces.
2. Coupling graspable physical objects to relevant digital information.
3. Using of ambient media (e.g. sound, light, temperature, etc.) for presenting digital information to peripheral attention.

The *ambient light display* (Figure 2.1c) exhibits the first and third aspects. The display is based on a shallow water tank. The tank contains a float that is pulled by a solenoid, which causes ripples of varying intensity in the water. Light is projected onto the water surface from above, and is reflected onto the ceiling. This transforms the ceiling into a display creating a subtle ambient effect as ripples in the water are reflected in the light *(aspect 1)*. Through this, users can monitor an information source of their choosing on the periphery of their attention - changes in the data are mapped to changes in the ripple intensity and visualized in the reflected ambient light *(aspect 3)*.

Phicons (Figure 2.1b) exhibit the second aspect. A *phicon* is a graspable object that serves as a physical embodiment of a digital information "source", i.e. a handle to digital information,

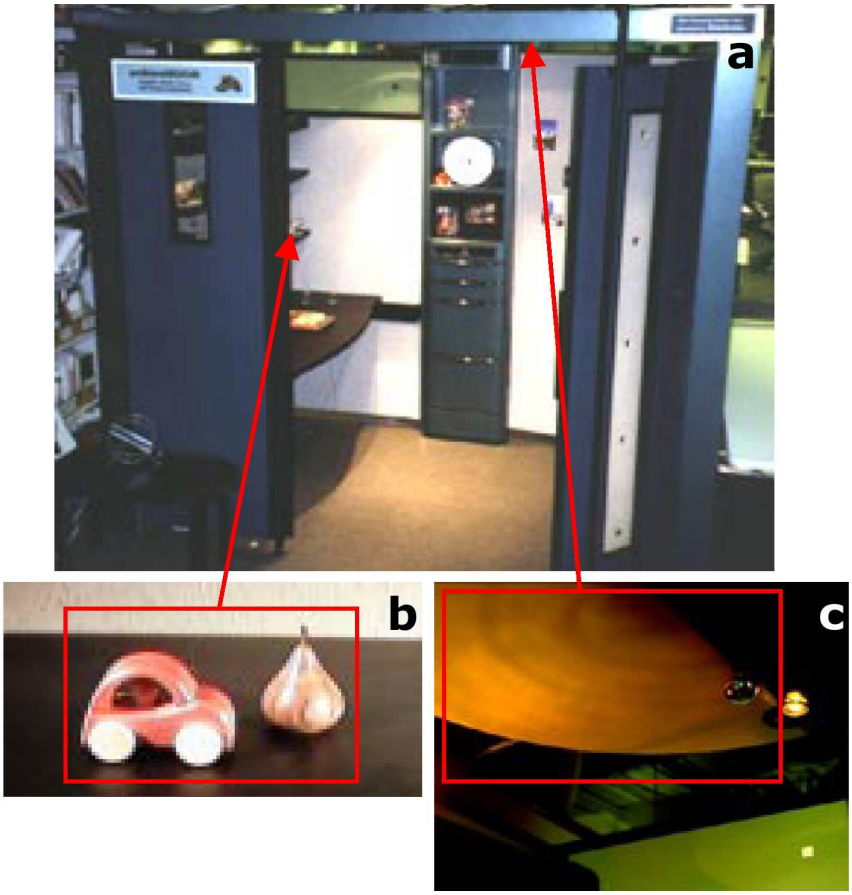


Figure 2.1: The ambientROOM prototype [Ishii and Ullmer, 1997]: a) the room, b) phicons, c) ambient light display on ceiling.

similar to an icon in a Graphical User Interface. The digital information coupled with the phicon can be transfered to, and rendered by an information "sink" (e.g. a display) simply by placing the phicon near the "sink". For example, consider the toy car in Figure 2.1b. When used as a phicon as part of a tangible interface in the manufacturers' office, the physical presence of the toy car could serve as both a reminder and a link to check hits to an advertisement for the toy car on the manufacturers' web page. The manufacturer could then place toy car near the *ambient light display* described previously, which would visualize the web page activity by increasing or decreasing the ripple intensity.

2.1.2 Augmenting Everyday Objects

Tangible Bits are the underlying mechanisms that link digital information and physical objects. *Augmenting everyday objects* is a more holistic view of what is created when these linkages take place over physical objects with a well known set of affordances. Specifically, *Augmenting everyday objects* is a branch of Tangible Bits that couples digital information with existing physical objects encountered in day-to-day life [Ishii, 2008]. The advantage of this approach is that such objects are already commonplace, and will have some existing associated meaning or action that can be leveraged on to create an easily understood interface.

An example demonstrating this is the musicBottles installation [Ishii et al., 2001], which uses common glass bottles as an interface. The installation demonstrates that a challenge in designing systems based on augmenting everyday objects is determining a metaphor for interaction that can be implemented reliably, that exploit the affordances of the physical object, and will satisfy users' expectations. The metaphor used in musicBottles is that of the bottle as a container; uncorking or corking the bottle will release or contain information. In this case the bottles control musical instruments; an instrument track is heard through speakers by uncorking its corresponding bottle, and is silenced by recorking the bottle. This metaphor was chosen for its simplicity as more complex metaphors such as shaking or pouring the bottle would have been difficult to reliably engineer. Visitors to the installation quickly understood the metaphor. However, affordances of the physical object do create expectations: when a visitor tried to cover the bottle with their finger or hand, they expected that this would stop the bottle and corresponding instrument.

The Audio Notebook [Stifelman, 1996] demonstrates how augmenting everyday objects allows users to build on their existing practices. Intended for settings such as lecture note taking, the Audio Notebook builds upon an ordinary pen and paper notebook. It is augmented with the capability to record digital audio, which is then indexed by the writing and page turns as notes are taken on the paper notepad. Once recorded, audio can be replayed by pointing to

the area in the notes where it occurred. A small study of note takers revealed that the Audio Notebook was enjoyed because it added functionality while allowing people to take notes in the way they were used to, rather than having to switch to a tablet or laptop for note taking.

LumiTouch [Chang et al., 2001] is intended to provide an emotional link between couples who work or live separately via linked framed photos. Framed photos are commonly kept to maintain an emotional link to loved ones. LumiTouch leverages this to create opportunities for passive and active abstract communication. When a user simply sits within proximity of the LumiTouch, the system passively communicates their remote presence by causing the corresponding users' frame to glow. Active communication can be provided by picking up and squeezing the frame, which triggers flashes of colored light to be sent to corresponding users' frame.

2.2 Ubiquitous Computing

Tangible computing provides the building blocks for a larger vision for computing systems known as *Ubiquitous computing*. As defined by Mark Weiser:

> *"Ubiquitous computing is the method of enhancing computer use by making many computers available throughout the physical environment, but making them effectively invisible to the user."* - [Weiser, 1993]

Ubiquitous computing, or UbiComp, departs from the notion of the "personal" computers. Desktop PC's, and even mobile devices such as laptops or PDA's, provide a single focus for users' attention and act as agents through which computing is accomplished. In contrast, UbiComp attempts to make computing a seamless aspect of the everyday world, allowing users to be *"freed to use [it] without thinking and so to focus beyond them on new goals"* [Weiser, 1991].

2.2.1 Location and Scale

When Weiser presented his early UbiComp systems [Weiser, 1991], he focused on two key design aspects: location and scale.

Location encapsulates the idea that UbiComp systems should exploit their location and surroundings:

> *"Little is more basic to human perception than physical juxtaposition, and so ubiquitous computers must know where they are."* - [Weiser, 1991]

An example technology for this is the active badge - a wearable device that identifies itself to sensors in the surrounding environment, which in turn allows the system to know where these sensors are located [Want et al., 1992]. Thus, people and objects equipped with active badges can be detected or tracked, opening up rich possibilities for personalization without the use of artificial intelligence:

> *"...doors open only to the right badge wearer, rooms greet people by name, telephone calls can be automatically forwarded to wherever the recipient may be, receptionists actually know were people are, computer terminals retrieve the preferences of whoever is sitting at them, and appointment diaries write themselves."* [Weiser, 1991]

Scale encapsulates the idea that UbiComp will come in a variety of shapes and sizes, amenable to their specific purposes. Weiser describes three displays developed by PARC, each scaled differently and each provide different sets of functionality. Shown in Figure 2.2, these are the "inch" scale Tab, the "foot" scale Pad, and the "yard" scale Board.

The Tab (Figure 2.2a), is analogous in scale to the sticky-note, and can be used as a highly portable storage of information. The functionally of a Tab is increased even further by incorporating active badge technology, allowing them to be tracked in the environment. The Pad (Figure 2.2b), is analogous in scale to a piece of paper, and can be used in a similar fashion to

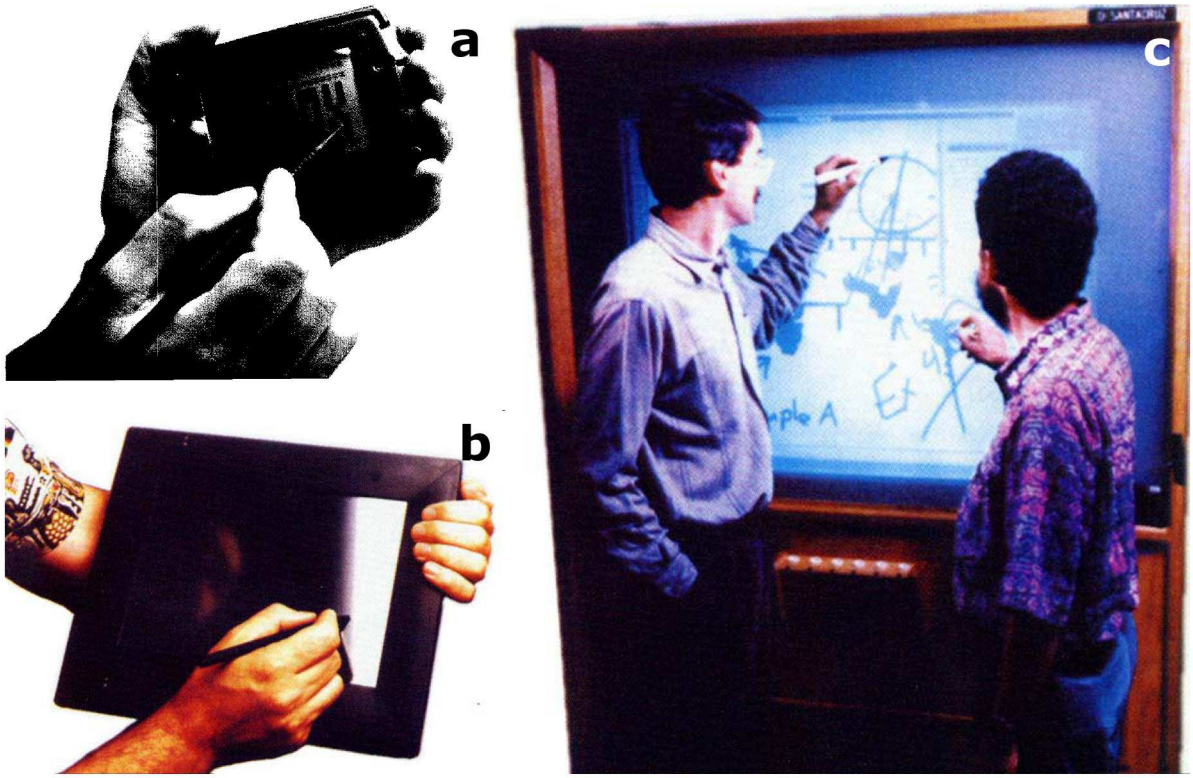


Figure 2.2: Differently scaled displays introduced by PARC [Weiser, 1993]: a) the “inch” scale Tab, b) the “foot” scale pad, c) the “yard” scale board.

personal computers. Unlike personal computers, Pads are not individualized; there are many of these and they are portable. They are meant to be grabbed and used at any time necessary. The Board (Figure 2.2c), being similar in scale to bulletin board or whiteboard, can be used as a shared display, such as in meetings.

The notions of location and scale described in these examples serve as building blocks. However, the power of UbiComp is only realized when many such devices are situated within the environment. The next sections describe two effects of moving computing “off the desktop” and into the everyday environment: *embodied interaction* and *calm technology*.

2.2.2 Embodied Interaction

The concepts of embodiment and embodied interaction, discussed in full by Dourish, are defined as:

> "*Embodiment is the property of our engagement with the world that allows us to make it meaningful.*"
>
> "*Embodied Interaction is the creation, manipulation, and sharing of meaning through engaged interaction with artifacts.*" - [Dourish, 2001]

UbiComp and tangible computing create embodied interaction by grounding interaction into the everyday world. Making computing "invisible" and allowing people to interact with it using everyday physical skills encourages a "direct" approach to interaction. As a result, these interactions create meaning in the real world; the processes used to carry them out and understand them are the same.

As an example, Pads can be used to spatially arrange documents on a desk, similar to paper. These arrangements can create meaning: related documents can be kept together, documents requiring immediate attention can be placed in the center of the workspace, while others can be placed out of the way. The arrangements can also be understood by others. They might notice a particular topic being worked on and offer assistance, or guage how busy their colleague is.

2.2.3 Calm Technology

Calm technology considers how technologies that transition between peripheral and foreground attention can create a calming effect [Weiser and Brown, 1996].

Typically, personal computing technologies require central, or foreground, attention. Information is presented at a single point of focus (i.e. the screen), which the user must explicitly monitor. Information overload is caused when the amount of information that must be attended to in this way increases; this in turn leads to frustration.

Alternatively, a calm technology places information on the periphery of attention. This is encalming for two reasons. First, when placed on the periphery of attention, more information can be attuned to without resulting in information overload. Second, information in periphery attention can transition into foreground attention when it is appropriate to do so.

The ambientROOM shown in Figure 2.1a is a room that integrates aspects of Tangible Bits to form a calm technology [Ishii and Ullmer, 1997]. Reconsider the example of the toy car phicon and the *ambient light display* in the toy manufacturers' office; placing the toy car near the display visualizes activity on the toy's advertisement web page. The subtle ripples in the ceiling display allow the manufacturer to monitor the information in peripheral attention. However, if a change occurs, such as an increase in activity, the increased intensity of the ripples alert the manufacturer to the change. In turn, they may bring the phicon, and associated information, to a foreground graphical display for a more detailed view.

2.3 Domestic Computing

Domestic computing looks specifically at the design of technologies for the home. Computing systems are now commonplace within the home, for example, personal computers, wireless networking, always-on broadband internet connections, and mobile devices. However, these computing systems, considered a sub-discipline of ubiquitous computing, are often adapted from technologies originally designed for the workplace, and indeed much of the research in computing systems has focused on the workplace until recently [Hindus, 1999].

Nevertheless, the proliferation of computing technologies in the home has resulted in an increasing interest in transforming the domestic environment into the "smart" home. In this vision, embedded technologies augment the home, opening up possibilities for context-aware systems that implicitly interact with inhabitants [Meyer and Rakotonirainy, 2003]. One example is rooms that customize their actions according to inhabitants' preferences, e.g., in how they provide lighting, music, pictures, television programs, etc. Another example involves

those who require assisted living, such as the sick or elderly, e.g. providing reminders to take medication, and monitoring activity to alert caretakers when assistance is needed.

Technology design for the home requires consideration of users, values, contexts, and issues that differ from the workplace [Edwards and Grinter, 2001, Hindus, 1999]. To this extent, various researchers have custom built homes as a testbed for evaluating new domestic technologies. An example is the Georgia Tech Aware Home [Kientz et al., 2008], built to prototype "smart" home technologies within a simulated domestic environment by readily allowing devices and sensor mechanisms to be installed throughout.

Ubiquitous and tangible computing ideas are common in domestic computing systems research. Technologies are rendered invisible by seamlessly integrating them throughout the home, and context-aware "smart" systems make use of information about their surrounding environment to provide functionality. Much of this research relies on understandings of the social environment and practices undertaken in homes in order to produce systems that fit in with existing domestic routines. The next sections consider how social computing is used to build understandings of domestic routines, and how this relates to ubiquitous and tangible design solutions.

2.3.1 Social Computing in Studying the Home

While useful as a testbed for domestic technologies, there are still design challenges that can not be adequately anticipated in custom built laboratory homes. These challenges include technological concerns: introducing technologies into pre-existing homes that have not been custom designed for seamless integration, the lack of a system administrator in the home, and increased expectations of reliability for domestic technologies [Edwards and Grinter, 2001]. Of particular interest to our research are two other challenges that center on the social aspects of introducing technology in the home.

The first concerns how to design systems that fit in with the everyday routines of families. A cited example is the telephone, which was expected to be used for coordination or emergencies

rather than socializing. Nevertheless, telephones in the home have been widely adopted for conversing with friends and relatives. The challenge for designers is to create technologies:

> *"relying on...the stable and compelling routines of the home, rather than supposition, company dictate, fad, or marketing"* - [Edwards and Grinter, 2001]

The second challenge concerns how these new technologies impact and change the work done in the home and their social implications. For example, the introduction of television impacted the nature of parenting - parents now needed to be concerned with the amount of television watching and whether particular programs are appropriate for their children.

These challenges highlight a need to be mindful of the social aspects of the home when designing domestic technologies. Indeed, various researchers call for a methodology that involves building an understanding of domestic routines to inform the design of future systems [Crabtree et al., 2003, Edwards and Grinter, 2001, O'Brien and Rodden, 1997].

> *"Only by grounding our designs in such realities of the home will we have a better chance to minimize, or at least predict, the effects of our technologies."* - [Edwards and Grinter, 2001]

This position is part of a larger trend in system design research, known as social computing. Social computing involves informing the design computing systems with a sociological understanding of the context in which they are used. The role this understanding plays in technology design arises because:

> *"Computation is part of a richer fabric of relationships between people, institutions, and practices that sociology can help us explore."* - [Dourish, 2001]

Social computing has typically employed ethnographic data collection techniques and ethnomethodological approaches to analysis as a means to gain insight into work practices. Work practice refers to the methods people use to coordinate and "get things done" on a daily basis.

Without this insight, technologies based on a requirements analysis considering only the technical process for doing work can inadvertently hinder these practices [Dourish, 2001]. Extensive research has been conducted developing insights into office work practice using ethnographic observation. Currently, researchers are using these techniques to build a similar body of insights in the domestic environment to *"sensitise designers and developers to the character of 'real world' household domains"* [O'Brien and Rodden, 1997].

2.3.2 Embodied Interaction in the Home

The link between social computing and UbiComp comes through *Embodied Interaction*. As discussed previously, *Embodied Interaction* means the interactions between people and computers become directly meaningful in the everyday world. This in turn creates the opportunity for designing systems that fit in with the 'real world' routines considered in social computing. As such, social and ubiquitous computing are commonly used together in studying and designing domestic computing.

For example, Crabtree et al. had families record communication information coming in and out of their homes, and what was done with that information [Crabtree et al., 2003]. This study revealed patterns of how information moved through the home, and that the various locations used formed an *ecology of practices* allowing the information to be managed (i.e. allowing them to find, act upon, or display for others' attention). Elliot et al. verified and extended this in presenting the concept of *contextual locations* [Elliot et al., 2005]. Contextual locations describe how the very locations communications were placed in carried with them meta-data allowing families to understand that info, i.e. who it is for, when it must be acted upon, and providing an awareness of the activities of others. These studies highlight a weakness of digital technologies in the home - while touted for their abilities to provide rich information, conventional digital information is tied to personal computers, and can not take advantage of contextual locations to be understood.

These investigations motivate solutions based on ubiquitous and tangible computing. For

example, the various locations used in information management are prime places for situating new displays [Crabtree et al., 2003]. Building on this, messaging systems could then allow information to be sent to particular displays in the home, taking advantage of the context provided by their location [Elliot et al., 2007a]. Another solution is to create information appliances that provide an ambient display of appropriate information depending on where they are placed [Elliot et al., 2007b].

2.4 Photo Sharing in the Home

In looking to encourage digital photo sharing in the home, our research targets a specific culture around photography known as *Kodak culture*, whose practices were described by anthropologist Richard Chalfen [Chalfen, 1987]. In the *Kodak culture*, photography is undertaken by ordinary people (as opposed to the work of professional and hobbyist photographers), who use photographs to participate in *home mode* communication. *Home mode* refers to *"a pattern of interpersonal and small group communication centered around the home"*, which is different from *mass mode* communication seen in media such as newspapers, magazines, television, etc.

Chalfen emphasizes storytelling as a dominant feature of how photos are interpreted and shared within *Kodak culture* [Chalfen, 1987]. He argues that the meaning of home mode photos is not communicated by the photos themselves, but rather the accompanying stories reflected on and told by viewers. Storytelling and discussion is expected when showing photos, where it can encourage continued participation by providing opportunities for further photo sharing or photo taking.

Chalfen's work took place before digital photography became commonplace, and the practices described assumed traditional film camera and print technology. Although digital cameras and internet photo sharing have changed the technologies involved in photography, the notion of *Kodak culture* is still relevant. Miller and Edwards [Miller and Edwards, 2007] reconsidered the practices of *Kodak culture* participants with digital photos. They found that websites for

digital photo sharing, such as Flickr.com, are largely unadopted by *Kodak culture* participants. Rather, these participants often relied on printed versions for sharing, but showed a preference for using e-mail when sharing digital photos. This was attributed to a discord between the affordances websites provide for sharing at a global level, and the *Kodak culture* desire for storytelling between close groups of friends and relatives.

However, this is not to say photo sharing websites have not been adopted. Indeed, Miller and Edwards described a new culture of practices emerging around them, which they refer to as *Snapr culture* [Miller and Edwards, 2007]. While *Snapprs* may use photography to document their lives in a similar fashion to Kodak culture participants, they aim to share photos with the online community rather than a small circle of family and friends through the use of photo sharing websites. In this case, sharing relies less on storytelling and more on aesthetics and the art of photo taking.

2.4.1 Storytelling With Photoware

The term *photoware* refers to systems for photo sharing. Frohlich et al. provided a mapping of the design space for photoware based on the groupware framework [Frohlich et al., 2002]. Shown in Table 2.1, the framework delineates four areas for photoware development: *co-present sharing*, *archiving*, *remote sharing*, and *sending*. Our discussion of photoware research will focus on work with co-present sharing aspects as it is most relevant to our own research. However, we will refer to these areas in our discussion.

Much of the research on photoware involves studying and supporting storytelling. An example is the hand held StoryTrack device [Balabanović et al., 2000] shown in Figure 2.3. Stories are used as the organizational metaphor with storytrack: imported stories act as “rolls of film” from which photos can be selected to create authored stories. StoryTrack supports storytelling in both co-present sharing, and sending. For co-present sharing, the form factor of the device allows it to be held and passed around in much the same way a printed photo would. As well, the device is interacted with via a set of buttons, allowing shared control that would

	SAME TIME	DIFFERENT TIME
SAME PLACE	Prints Slides and Projector CO-PRESENT SHARING *Photo viewing software and devices*	Shoeboxes Albums/Frames ARCHIVING *CD-ROM* *PC Filestore* *Photo Website*
DIFFERENT PLACE	Telephone REMOTE SHARING *Application sharing* *Instant Messaging* *Video Conferencing*	Mail SENDING *Email attachment or website reference* *Internet photo frames*

Table 2.1: Design space for photoware with example technologies for print and digital sharing [Frohlich et al., 2002].

otherwise be difficult on a personal computer. Additionally, voice annotations (i.e. storytelling) are easily recorded and associated with photos during co-present sharing, or when authoring a story alone. Sharing and storytelling via sending is supported as authored stories, including voice annotations, can be packaged and sent to others.

Other researchers have examined co-present storytelling over photos to elicit requirements for photoware. Frohlich et al. examined co-present sharing events of participant families over the course of three months [Frohlich et al., 2002]. Participants reported this form of photo sharing was the most enjoyable as it allowed them to relive and show off their experiences to others through the stories told. They also showed a strong preference for prints when sharing in this manner - of 127 recorded events only 7 took place over photos displayed digitally. Participants attributed this to the manipulability of prints, which was an enjoyable factor when sharing photos. 80 of these events were audio recorded and analyzed, revealing two distinct kinds of photo-talk: **storytelling** that occurred mainly when photos were shown to people who were not present at the original event, and **reminiscing** that involved *"jointly 'finding' the*

Figure 2.3: The hand held StoryTrack device [Balabanović et al., 2000].

memory together" amongst people who shared the experience.

Crabtree et al. investigated "embodied-interactional" properties inherent in storytelling around print photos [Crabtree et al., 2004]. Their work builds on the observation that co-present sharing around physical prints was most enjoyable, and the manipulability of prints played a role in this [Frohlich et al., 2002]. By studying these properties, their intent was to leverage them to enhance remote sharing of digital photos. In observing video recordings of sharing events, their findings centered on two embodied aspects influencing storytelling and sharing: *situated arrangements*, and *gesturing*. *Situated arrangements* considers how physical photos lead to an *ecology of practices* guiding the photo sharing event. For example, piles of photos act as *control centers* - their visibility and manipulability provides opportunities participants to direct (or redirect) the photo sharing event, or break off into subgroups discussing

different topics. *Gesturing* refers to the ability of participants to point and orient photos in order to direct the attention of others.

The studies discussed so far have looked at sharing around physical prints as they were preferred for co-present sharing. Motivated by the popularity of digital photography, Lindley and Mark sought to study co-present sharing around current digital displays to determine how suitable affordances for sharing in this manner could be provided [Lindley and Monk, 2006]. Through interviews with participants about their photo sharing experiences around both digital technologies (i.e. personal computers, TV), and prints, their findings illustrated three key issues: affordances for *enjoyment*, *conversation*, and *control*. For *enjoyment*, participants liked viewing photos on large, high-resolution displays, but disliked the need for crowding around a laptop or monitor when showing to larger groups. Also, the presence of many similar shots taken with digital cameras could make sharing boring. For *conversation*, prints were preferred for facilitating the interactions discussed previously by Crabtree et al. [Crabtree et al., 2004]. Additionally, social rooms (e.g. the living room) were preferred as they provided an environment suitable for conversing. Also, slide show modes for showing digital photos were seen to inhibit conversation by restricting the flow of sharing. Finally, for *control*, while participants liked that control in sharing prints was distributed amongst the group, the potential this posed for subgroups breaking off and discussing different photos was seen as problematic. Showing photos digitally was seen as advantageous in this respect, but at the same time placed control into the hands of one person.

2.4.2 Archiving

While our research looks to encourage co-present sharing in the home, archiving and organization practices are worth considering as they affect how photos are made available for sharing. Frohlich et al. presented a look at families archiving practices with print and digital photos [Frohlich et al., 2002]. Archiving prints mainly involved the culling and placement of photos into albums. While organized albums were desirable, this was a tedious and time-consuming

task. Often a minimal preliminary effort to organize the photos was undertaken on receiving them, with the intent of adding more detail (e.g. captioning, dates, etc.) later. However, this work was often left undone, and details would be forgotten. There was hope that digital systems would help, yet digital photo organization was minimal - most commonly folders were used similarly to print envelopes. It was speculated that this could be because families had not adopted digital as their main form of photography (the study took place in 1998).

Subsequent studies have shown similar findings. Rodden and Wood studied how participants used various organization features in Shoebox, a digital photo management system [Rodden and Wood, 2003]. Shoebox allowed participants to organize photos into rolls, and these were mostly used to separate photos into events or periods of time in much the same way folders were seen used by Frohlich [Frohlich et al., 2002]. The software also allowed more advanced features. Photos could be annotated via typed or spoken (and voice recognized) descriptions. These descriptions allowed text query, and image analysis allowed query by visual content. Yet, it was found that these advanced features were seldom used. Rodden and Wood noted that adoption may have been affected by unreliability in image analysis, voice recognition, and the implementation of Shoebox. However, they also speculated searches for particular photos based on details may not be as necessary as simply browsing by approximate time or event.

Other researchers have continued to look at how people search and browse their photo archives. Kirk et al. examined *photowork* - the organization and management people do to make their digital photos ready for sharing [Kirk et al., 2006]. They found a similar reliance on the simple date/event based folder schemes. They noted that people could easily narrow the search space for photos: recent photos were browsed most often, and the folders could be used to further narrow the search to a particular time or event. Bentley et al. noticed two patterns of behavior in browsing photo collections, *satisficing*, and *sidetracking* [Bentley et al., 2006]. *Satisficing* is when photo searching is stopped when a “good enough” photo is found, rather

than continuing to search for a more optimal particular photo. *Sidetracking* is when photos encountered in searching change the direction of the search, providing opportunities to browse for photos that may have been forgotten or were not the original intent of the search.

These results suggest that query searches for specific photos may not be necessary for personal/family photo collections. However, this is not to say that simple date/event folder organizations are entirely adequate with no potential for improvement. Cui et al. suggest that improving affordances for annotating digital photos could improve organization [Cui et al., 2007]. Their system, EasyAlbum, looks at combining automated face recognition and clustering with user input to ease the task of annotation. Their findings show the system does reduce the workload of tagging photos, but it remains to be seen how such a system would be adopted in practice. The debate regarding the need for more sophisticated organizations is outside the scope of our research, but the persistence of simple time/event schemes will be of interest in our consideration current practices with print and digital photos.

2.4.3 Photo Displays

While photo frames are listed as archiving in the photoware framework (Table 2.1), photos displays in the home can be considered as a means for both archiving and co-present sharing. Kim and Zimmerman investigated photos displayed in the home, and social interactions around them. In particular they noted two categories of photo displays that had different potentials for social interaction: *formal*, and *informal*. *Formal* displays refers to professional posed photos (e.g. graduation photos, family portraits, etc.). While these offered potential to start conversation with guests, it was the personal and candid *informal* displays that provided greater opportunity for storytelling.

Swan and Taylor looked at particular examples of photo displays, and how their arrangements and properties convey meaning to home inhabitants and guests [Swan and Taylor, 2008]. For example, the positioning of two framed photos - one prominently visible, one somewhat obscured - can relay a message of the relative importance placed on them. The message may

or may not have been intentionally created, but nevertheless artifacts of print photo displays in the home can convey impressions of the home and affect the storytelling narratives given around the displays.

The motivation for both these investigations is that while digital cameras and storage of digital photos on computers has become commonplace, there have been few new technologies for displaying digital photos. Thus, they aimed to uncover aspects to consider in designing novel photo display technologies for the home. However, the social aspects revealed in their investigations is relevant to our work, as displayed photos in the home can serve a similar purpose to displayed souvenirs and mementos.

2.5 Souvenirs and Mementos as Memory Evoking Objects

In Chapter 1 we mentioned Don Norman's discussion of the value of souvenirs as memory evoking objects [Norman, 2003]. A study by Csikszentmihalyi and Rochberg-Halton supports this [Csikszentmihalyi and Rochberg-Halton, 1981]. Among the most cherished objects in the home, they categorized objects valued as *mementos*, *recollection*, *heirlooms*, and *souvenirs* as valued for their associated memories. However, their work lacked a detailed discussion of these objects, instead looking at the broader meanings and sense of self created by objects in the home. A focus group study to define "souvenir" turned up a variety of potential meanings: objects symbolizing relationships between people, places, moments, etc., objects that have emotional value, or objects used to evoke memories. However, all definitions involved *"physical objects to which memories are attached"* [van den Hoven and Eggen, 2005].

Because of their role in evoking memories, various researchers have considered using souvenirs in tangible computing systems to support recollection. A focus group and questionnaire study showed positive results for such use [van den Hoven and Eggen, 2005]. Participants' most valued souvenirs were often kept in the living room, and were on display. Of 30 participants, 22 reported having media related to their most valued souvenirs - photos were most

Figure 2.4: Photo Browser [van den Hoven and Eggen, 2003] uses links between physical souvenirs and digital photos for memory recollection.

common, but other souvenirs, music, video, etc. were reported.

An example system built around photo and souvenir linking (similar to ours) is Photo Browser [van den Hoven and Eggen, 2003], shown in Figure 2.4, which is a hand held device used as part of an in-home environment for memory recollection. The device provides an interface for browsing photo collections, as well as a means to send individual photos to alternate displays (e.g. a digital photo frame or TV). As well, Photo Browser can recognize physical souvenirs. Users can then drag individual photos to be associated, or browse the set of associated photos. While Photo Browser links physical souvenirs to digital photos, the focus of the research was for memory recollection rather than how the system could be used to encourage photo sharing.

A different take on the use of souvenirs for memory recollection is shown in the Memory Shelf and Anniversary Plinth systems [Frohlich and Fennell, 2007]. The Memory Shelf (Figure 2.5a) uses physical souvenirs as links to audio messages. A new message can be recorded, or existing messages can be played back by placing souvenirs on the shelf. The Anniversary Plinth (Figure 2.5b) associates text descriptions to physical souvenirs to produce a printed record their

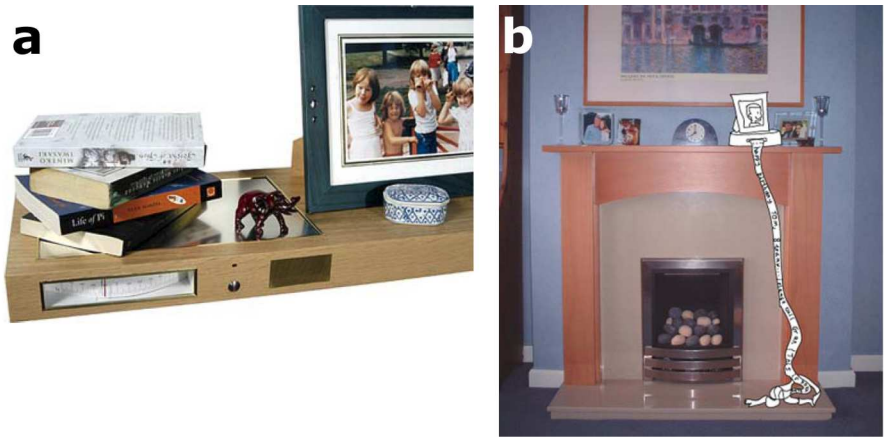


Figure 2.5: Memory recollection with physical souvenirs [Frohlich and Fennell, 2007]: a) Memory Shelf, b) Anniversary Plinth.

history. Noting that the meanings associated with a souvenir can change, text descriptions can be added over time (e.g. information from the manufacturer, date of purchase, notes from previous owners, etc.).

Memodules is a technological framework to create tangible interfaces for memory recollection using personal objects [Mugellini et al., 2007]. The framework has three components. First, the **'Lay and Play'** (Figure 2.6a) allows objects tagged with RFID tags to be recognized and photographed for use with the system. Second, the **Action Builder** (Figure 2.6b) used to program scenarios linking physical objects to digital actions and information (e.g. linking a souvenir to a slide show of photos). Third, is the **Memodules Console** (2.6c) for acting out scenarios, which provides RFID readers to recognized tagged objects, as well as various sensors and and LCD display to interact with the system (e.g. to scroll through photos). Memodules can be used to build systems using physical souvenirs, such as those previously discussed. However, the goal of the framework is to encourage explorations of such systems, rather than focusing on how particular applications (e.g. linking photos to souvenirs) might be used in practice.

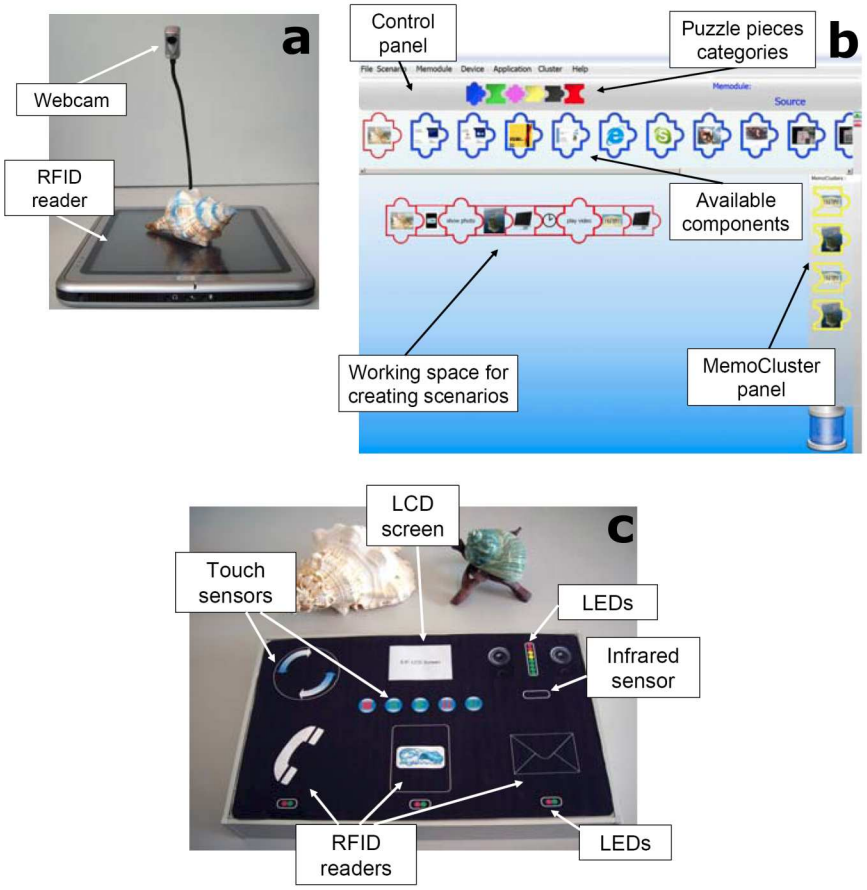


Figure 2.6: The Memodules framework [Mugellini et al., 2007] for creating tangible interfaces using personal objects: a) Lay and Play, b) Action Builder, c) Memodules Console.

2.6 Summary

The first three sections of this chapter presented the intellectual foundations for our work. *Tangible computing* enables everyday physical artifacts with digital capabilities The result is that interfaces can leverage on users' existing skills in interpreting and interacting with them. This approach provides building blocks for *ubiquitous computing*, which seeks to make computing a seamless part of the everyday world. We then turned our attention to *domestic computing*, where researchers are using *social computing* ideas to understand the home in order to design technologies that fit in to its social environment. *Embodied interaction* provides the link between social/domestic computing and UbiComp. When computing is integrated into the ev-

eryday world, interactions with it become intelligible to others. In turn they become integrated in the social environment.

The remaining two sections focused on work related to our specific area of research - encouraging photo sharing through physical souvenirs. We discussed the importance of storytelling in *Kodak culture* photo sharing, and how it continues to play a role in the development of photoware. While studies have looked at how affordances for storytelling and photo sharing events are provided with prints and digital photos, we do not have an understanding of how photo sharing is motivated and can be encouraged or discouraged in the home. We have seen work on archiving practices, but we do not know how they bridge into and affect potential opportunities for photo sharing.

We have also presented a look at how displays of photos can become social instruments in the home, and expect that souvenir displays can play a similar role. Research has shown the power of souvenirs as memory-evoking objects, and looked to use them as links to digital information (such as photos). While these systems aimed to support memory recollection, we wish to build upon this work by examining how souvenirs displayed in the home could encourage digital photo sharing. We have seen some information on how souvenirs are dispersed through the home, but we do not sufficiently understand what kinds are kept, and how they are situated in the home so that they might be amenable for use in such a system.

In the next chapter, I will discuss a prototype system built on the foundations discussed in this chapter. We use this system, which links physical souvenirs and mementos to digital photo sets, in order to further explore these issues in a study described in Chapter 4. Chapters 5, 6, and 7 present our study results, which validate and extend the understandings of domestic photo and souvenir use presented in this review.

Chapter 3

Souvenirs: Sharing Through Tangible Forms

In this chapter I will discuss the rationale for and design of SOUVENIRS; a system that encourages face to face digital photo sharing in the home. SOUVENIRS is inspired by previous research in the fields of ubiquitous, tangible, and domestic computing - it is designed around the premise of using physical souvenirs and mementos displayed throughout the home as tangible icons linking to sets of digital photos.

3.1 Usage Scenario

In order to illustrate the design rationale motivating SOUVENIRS I will present a scenario describing how we envision the system could be put to use in the context of the domestic environment.

To introduce our scenario, consider Bob. Bob has just returned home from a two week vacation wherein he and his wife, Alice, went hiking in Alaska. Over the course of his hikes he took many photos with his digital camera. Additionally, he brought home a peculiarly shaped rock he found on one of his hikes. This is something he customarily does, where he collects a souvenir from his various hiking trips for displaying in his home.

After returning home, Bob transfered the photos from his camera into a folder on the media center computer connected to a large plasma display in the living room (i.e., the home TV). He has SOUVENIRS set up on this computer, and decides to link the photos from his hike to the rock he has collected. The actual rock will be displayed along with other rocks and photos he keeps on a shelf in the living room. Bob first affixes an RFID tag sticker to the rock, which allows it to be recognized by the system (Figure 3.1a). He then drags the folder of photos on the computer into the SOUVENIRS window, which marks the photos as a set within the system

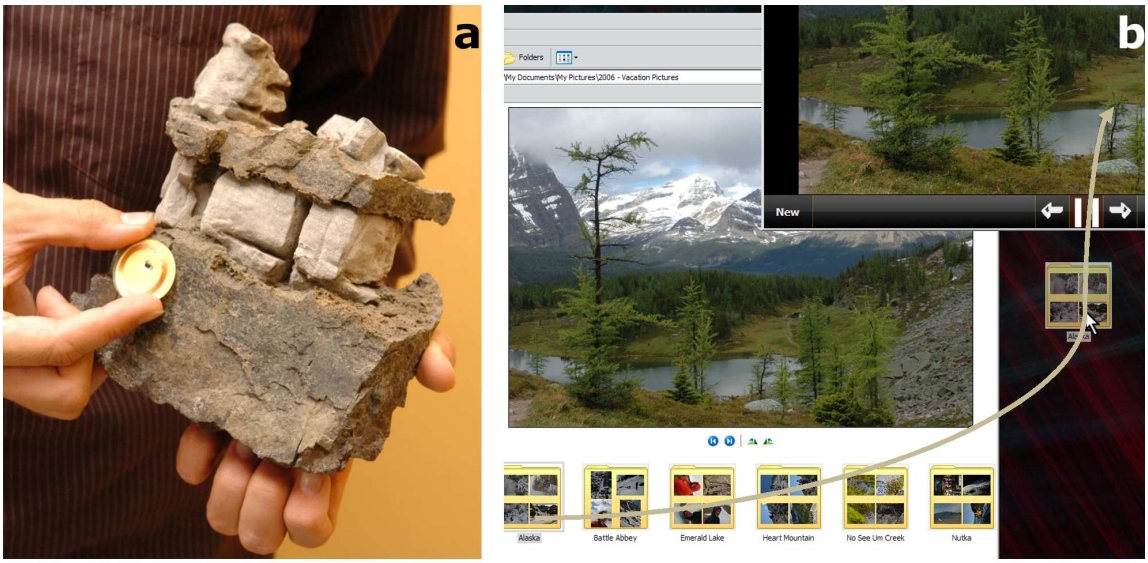
(Figure 3.1b). Alternatively, he could have built the set by dragging individual photos into the window, rather than using all the photos in an single folder. Now that the photos are in the system and the rock has been tagged, he simply places the rock on the SOUVENIRS sensor base next to the display. The tag is recognized by the system. Because the system has not seen this tag before, it brings up a dialog asking if he would like to link the photo set to the souvenir. It also allows him to give the photo set a name (Figure 3.1c). He links the photos to the tagged rock, and closes the SOUVENIRS window on the computer. He then places the rock on the display shelf (Figure 3.1d); thus completing the setup process to create the link.

Later that day, Alice returns home. She notices the rock, which Bob placed on the display shelf. They begin to discuss the trip, and Alice asks if she could see how the pictures turned out (Figure 3.2a). Bob places the rock over the sensor base. The tag on the rock is recognized by SOUVENIRS, and a slideshow of the pictures is immediately shown on the plasma display (Figure 3.2b). Bob and Alice watch and reminisce about the trip (Figure 3.2c).

A few weeks pass, and one evening we find Alice has invited her friend Mallorie over for wine and cheese. Mallorie is an avid hiker as well, and mentions that she is considering possible destinations for a vacation she is planning and asks Alice if she has any suggestions. They get to talking about Alice's recent trips, and Alice mentions Alaska. Mallorie is intrigued, and so Alice decides to show her some of the photos from the trip. Alice takes the rock from the display and places it over the sensor base, bringing up the photos. As the evening continues they discuss some of the other trips Alice has been on, and Alice brings up photos from various places using the other souvenirs on the display shelf to retrieve them.

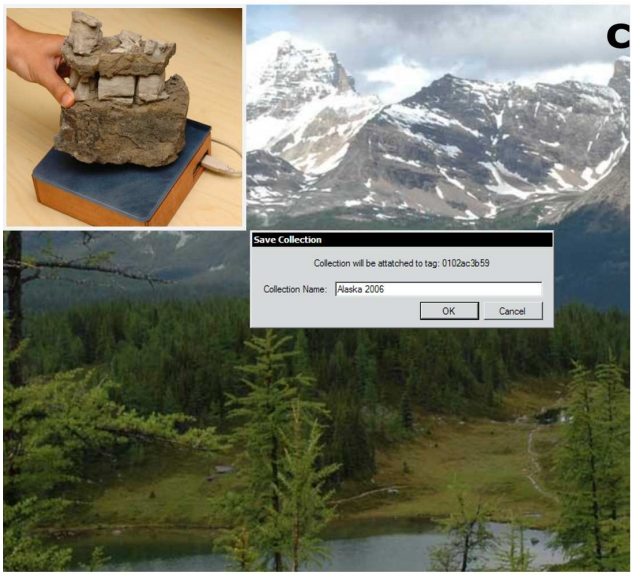
3.2 Design Rationale

The usage scenario presented previously is useful for our discussion as it demonstrates not only how the system works, but also contextually illustrates our design rationale behind how SOUVENIRS can encourage digital photo sharing in the home. A technical description of the



Bob tags the rock with an RFID sticker

He then drags the Alaska photos into the Souvenirs window

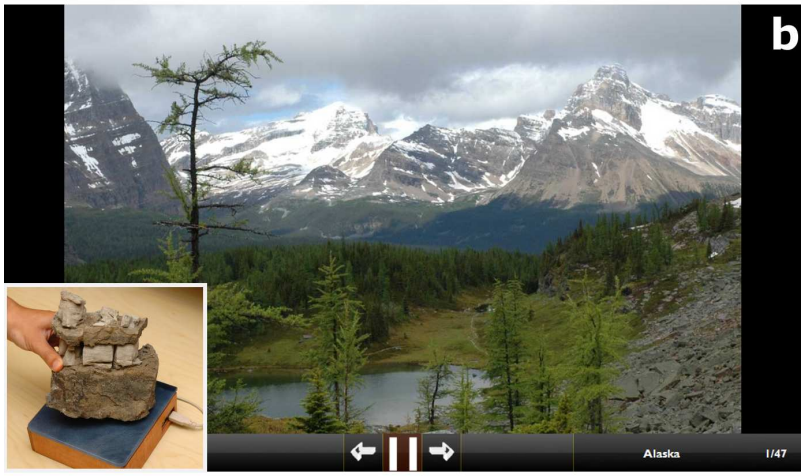


He waves the tagged rock over the sensor base. The system recognizes the tag and allows him to name and save the linked photo set

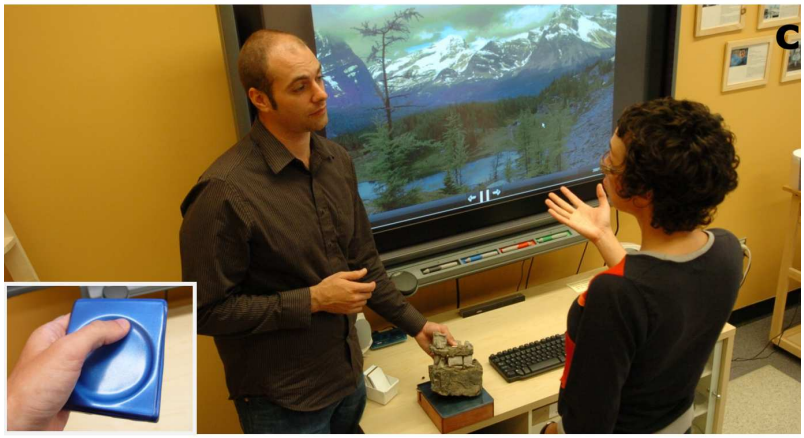
Now that the link has been created, Bob places the rock on his display shelf

Figure 3.1: Scenario demonstrating how to set up a link with SOUVENIRS

Bob and Alice converse over the displayed rock



Bob starts the slideshow by waving the rock over the sensor base



Storytelling over the Alaska photos

Figure 3.2: Scenario demonstrating photos sharing with SOUVENIRS

features of the prototype system and its implementation will be presented in a later section; in this section I will describe the ideas behind our design rationale, referring to illustrative examples in the usage scenario as appropriate.

3.2.1 Opportunistic Sharing Through Tangible Mementos

Perhaps the most prominent aspect of SOUVENIRS is the use of tangible mementos as links to digital photo sets. In Bob's case, the rock from Alaska becomes a symbolic link to the photos from the trip; however, as it is a physical item it can be placed on display in the home, just as any souvenir might routinely be displayed. Because of this, Bob's family are able to take advantage of the rock's location and visibility, allowing them to access the digital photos in a way that we believe allows photo sharing to occur naturally within the social face-to-face setting of the home.

We speculate that a physical memento can become a handle for displaying a particular digital photo set. In this way, it acts similarly to a URL or graphical icon; where a simple handle provides access to rich sets of information or functionality. Based on Norman's [Norman, 2003] discussion that describes souvenirs and photos as memory evoking objects, it seems reasonable to assume that a physical memento could naturally be linked to a photo set by the shared memories they evoke. When the memento is placed on display in the home it is something for others to notice. It can then act as a conversation piece leading to recollection of the associated memories or storytelling. In Bob's case this happens when Alice comes home and notices that the rock has been added to the display shelf, and during Alice's discussion with Mallorie about trips. The result is that the souvenir provides a lead-in for opportunistic photo sharing, which can then be easily invoked through the system.

Of course, opportunistic photo sharing in the home can also be supported through paper based solutions; framed photos placed on display, or photo albums located where they can be easily and quickly brought out to show guests. However, one of the benefits that has made digital photography successful is that it allows people to take and maintain more photos, which

would be costly to print and time-consuming to organize into albums. While subsets of the photos taken digitally may still be selected for printing, people are taking and storing photos increasingly with digital vs. film [Kirk et al., 2006]. Our intent with SOUVENIRS is not to replace prints for sharing, but to augment it by allowing photos from the digital collection to be made available for sharing without having to print and organize them all.

Our design rationale leverages the opportunities for photo sharing raised by the souvenir and memento displays kept in the home. Arguably, these displayed items could provide a lead-in to conventional photo sharing as is, where people could turn to existing methods to bring up and show the related digital photos (e.g. to move to a computer, logon, find the photos...etc.). The SOUVENIRS design also involves aspects that aid the transition into photo sharing within the home setting over the conventional methods. These aspects will be described next.

3.2.2 Shared Access

In many family homes the family photo collection is relevant to all family members - any of whom might wish to access them to share with a guest. For this to happen, all family members must know about and be able to access the photo collection. With print collections we believe this is a simple matter; they are easy to access, and due to their physical location in the home most family members would know where they were kept.

On the other hand, shared access to digital collections may be discouraged as a result of the single-user nature of current personal computers. Sets of digital photos are likely to wind up being kept under a personal user account belonging to whoever organized them. This can pose problems for shared access; anyone wanting to show the photos must know how to access the account (which may be password protected), and would then also need to know where and and how the photos had been organized in the filesystem in order to retrieve them. While restricting others' access may not be intentionally desired in this case, it is still unlikely that other family members would be able to access the photos on their own; this in turn diminishes opportunities for sharing.

An advantage to the design of SOUVENIRS is that shared access can be achieved through the use of displayed mementos. Similarly to print photo albums, the physical location of these items in the home allows them to be accessed by anyone. This is illustrated in our usage scenario when Alice brings up the photos from Alaska to show to Mallorie. Although Bob had originally organized the photos, she is able to access them with the displayed rock. She does not need to know how to access Bob's account, or where Bob might have put the photos within the file system. The same is true for any of the other rocks they have displayed; it no longer matters whether any particular photo set was organized by Bob or Alice, as both are now capable of discovering and showing them.

3.2.3 Technological Delays

Another aspect of the SOUVENIRS design is that delays that may occur in managing the technologies to show digital photos are minimized - delays that we believe act as barriers to opportunistic photo sharing in the home.

Some of these delays are the result of navigation problems. If a digital photo set is desired for sharing, the person showing the photos must navigate through the file system, or photo managing software, often needing to search through potentially long lists of folders, sets, or even individual photo files to find the desired photos. This can be a tedious process, which is particularly so if the location of the photos has been forgotten, or is unknown to the person trying to find them.

Additional delays can occur simply because the technology is not ready for immediate photo sharing. If sharing on a personal computer, this can include time spent booting up the computer system, or logging on to the desired user account. Also, once the photos have been located, there may be delays in invoking and navigating through the correct application to start a slideshow of the photos.

We suspect that these delays will be undesirable, particularly since others would be watching. As such this might make people reluctant to show digital photos, or make the event boring

for guests. With SOUVENIRS, these delays are minimized. In Bob's case, when Alice asks to see the photos, he is able to bring them up immediately by placing the rock over the sensor base.

3.2.4 Social Setting

Finally, SOUVENIRS is designed to fit in to the social setting present in the domestic environment. It does this in two ways: through its location, and through the display.

Firstly, personal computers in homes today tend to be kept in some out of the way corner, such as in a home office or den. These locations are not typically used for entertaining guests; thus guests must be brought to this area in order to be shown photos kept on the computer. This can be interruptive in itself, but these areas lack the furnishings and space required to comfortably accommodate onlookers. SOUVENIRS, on the other hand, places photo sharing in the living room - an area that is suitable and commonly used for entertaining guests. This encourages opportunities for photo sharing as it is readily available where people already are, and it allows everyone to watch in comfort. Such is the case with Mallorie and Alice; they can continue to enjoy their wine and cheese as they browse the various hike photos.

Additionally, SOUVENIRS is intended to make use of a next-generation large television display, which are becoming increasingly affordable and common in the home. Such a display allows more people to comfortably view the photos than would a typical computer monitor designed for a single-user.

3.3 Prototype System

To demonstrate the SOUVENIRS concept, we implemented a prototype of the system. This prototype was used in a video demonstration showing how the system worked in the context of the home. This video will be discussed further in the next chapter, which discusses the methodology of a study we conducted where the video was used to introduce the system to

participant families. In this section I will describe the hardware and software implementation of the prototype system.

3.3.1 Hardware Setup

The hardware setup for our prototype system consists of:

1. **Standard PC and large plasma display.** The basic components of the system are a standard PC connected to a large plasma display. The photos to be shared with the system are stored on the PC, which also runs the SOUVENIRS software. The PC and display are kept in a living room, providing a social setting for photos to be shown.

2. **Sensor base.** A sensor base is connected to the PC via USB and kept near the display. The sensor base provides a surface to place tagged objects to be recognized by the system. Inside, the sensor base contains a Phidget [Greenberg and Fitchett, 2001] RFID reader and a USB hub. The RFID reader allows the system to detect the tagged objects placed on or waved over the sensor base. The USB hub allows other devices, such as the scroll device, to be connected to the PC through the sensor base.

3. **Scroll device.** A circular touch scroll device is also connected to the PC via USB (through either the hub provided in the sensor base, or another available USB port), and allows users to scroll through a photo set, or toggle automatic slideshow mode. The scroll device consists of a Phidget circular touch component contained within a molded case allowing users to comfortably hold and use the device.

4. **RFID tags.** Clear thin sticker-backed RFID tags are used, which can easily be affixed to objects used with the system.

As we aimed the design of our system at the domestic environment, we hired an industrial designer to build custom cases for the external hardware items: the sensor base and scroll device. These cases were built to enclose the underlying Phidget hardware and provide the

required functionality in an aesthetically pleasing way, such as would be acceptable for use in the home.

3.3.2 Software Implementation

The software for the system was implemented in C# using .NET, and makes use of the Shared Phidgets toolkit [Marquardt and Greenberg, 2007] to connect to the hardware Phidget devices. The software is functionally simple, providing an interface similar to conventional slideshow software (shown in Figure 3.2b). We chose the slideshow format as it is typically seen as standard in current digital photo sharing software. Other displays that could provide a more flexible flow for browsing activity may be worth considering. However, our focus concerns the social practices around initiating photo sharing in the home, rather than browsing. Folders of photos or individual files can be added to the slideshow by dragging and dropping them in the slideshow window (as in Figure 3.1b). The photos in the set can then be scrolled through using either the circular touch device or the on screen forward/backward arrow buttons, or played in an automatic slideshow by double-tapping the circular touch device or using the on screen play/pause button. The system differs from conventional slideshow software; when an object with an RFID tag that has not already been linked by the system is detected by the sensor base, a dialog is shown allowing the set of photos in the slideshow window to be named, saved and linked to the RFID tag.

When a folder of photos is dropped in the slideshow window, the system looks for image files within the folder, and adds the file path for each image to the slideshow play list. Similarly, if an individual image file is dropped, the system appends the file path to the play list. The set is saved by the system when it is associated with an RFID tag and given a name. The library of sets stored by the system is maintained in an XML file. A simple example showing how a set is represented in the file is shown in Figure 3.3. The set has two properties, the name and associated RFID tag identifier. A list of all the photo files is contained in the set, recorded by their location in the filesystem. Internally, the system does not move or modify the original

```
<set name="Alaska" tagid="0102ac3b59">
    <photo location="C:\Documents and Settings\Bob\My Documents\My Pictures\Alaska\DSC0001.JPG" />
    <photo location="C:\Documents and Settings\Bob\My Documents\My Pictures\Alaska\DSC0002.JPG" />
    <photo location="C:\Documents and Settings\Bob\My Documents\My Pictures\Alaska\DSC0003.JPG" />
    <photo location="C:\Documents and Settings\Bob\My Documents\My Pictures\Alaska\DSC0004.JPG" />
    <photo location="C:\Documents and Settings\Bob\My Documents\My Pictures\Alaska\DSC0005.JPG" />
    <photo location="C:\Documents and Settings\Bob\My Documents\My Pictures\Alaska\DSC0006.JPG" />
    <photo location="C:\Documents and Settings\Bob\My Documents\My Pictures\Alaska\DSC0007.JPG" />
</set>
```

Figure 3.3: Example XML listing for a photo set.

photo files in any way; when a set is retrieved, the system simply opens the images from the locations listed. Of course, this scheme assumes the original images will not be removed; if an image is removed, its file location will no longer be valid. The system makes no attempt to resolve this, so any invalid image files will be skipped when viewing the slideshow. To invoke a slideshow, a linked object must be detected by the sensor base. The system checks if the RFID tag identifier is associated to a set in the XML file, and loads the photo locations from the matching set into the play list for the slideshow.

3.4 Summary

In this chapter I have presented motivation and design ideas behind SOUVENIRS, and a prototype implementation that was built to allow us to further explore the nuances of such a system. Our design is motivated by prior research, and indeed the very premise of systems linking digital photographs to physical memorabilia has been considered by tangible user interface researchers [Mugellini et al., 2007, van den Hoven and Eggen, 2005]. However, our interest in exploring the idea concerns what it might mean to have this system available for use within the domestic environment, and this is reflected by motivations in our design rationale.

This design rationale has been inspired by recent trends in domestic computing research, which suggest that moving computing “off the desktop” using ubiquitous and tangible systems may be beneficial in promoting digital information use in the home [Elliot et al., 2005, Crabtree et al., 2004]. With SOUVENIRS we are considering how this might be the case specif-

ically with digital photos. It is worth noting that our intent with this design is not to re-create the affordances of print photo albums with digital photos. Rather, our goal is to explore how links to physical memorabilia can mimic some of the social practices around sharing that are lost with digital photos, and to consider how new practices might emerge around this affordance.

So far, this chapter has presented our case for the system from a design rationale standpoint. To further this research we need to build an understanding of the current practices families have around their photograph and memento collections in order to verify our rationale and consider how SOUVENIRS might fit in with these practices. In the next chapter I will present the methodology for a study we conducted to fulfill this objective.

Chapter 4

Studying Photographs and Souvenirs Within the Home - Methodology

In the previous chapter I presented a description of our SOUVENIRS system. The design rationale behind SOUVENIRS was motivated by previous literature in the fields of ubiquitous and domestic computing, where our intent was to situate digital photograph collections within the physical environment in order to promote photo sharing and shared access to photo collections within the home. Yet we need an understanding of families' practices around the storage and sharing of print and digital photos, and of souvenirs and mementos. Without this understanding we cannot evaluate and critique the SOUVENIRS design. To address this, we conducted a study concerning people's practices with photos and souvenirs within the home. The methodology used in our study is more akin to a requirements analysis and critique of the system, rather than a strict evaluation. That is, the aim of the study was as much to observe families' current practices, look for opportunities for the system to fit in, and speculate on how the system might be adopted in the home, as it was to determine if participants liked or disliked the idea. This chapter describes the methodology used in our study, while subsequent chapters discuss our results.

4.1 Study Goals

The purpose of our study is to build an understanding of current domestic practices surrounding the storage and sharing of photograph and souvenir collections. From this understanding we will later critique the design of SOUVENIRS. We had three specific goals for the study:

Goal 1: Examine how families manage, display, and share their print and digital photos, and understand what advantages and difficulties they encounter in doing so. In particular, we want to know how the migration of photos from a primarily print to a primarily digital medium has affected how family members share photos within the home, and how they share access and knowledge of family photo collections between each other. Additionally, we wanted to discover what difficulties and advantages participants noted in the various ways they shared and managed their photo collections. The intended outcome of this goal is to verify the problem motivating SOUVENIRS, i.e., that current digital photo management strategies hinder in-home photo sharing and shared access to photo collections.

Goal 2: Examine how families collected souvenirs and mementos, as well as how and why they are stored and displayed within the home. With this goal we wanted to understand what kinds of souvenirs and mementos are typically collected, and why. We want to see where these items are stored, and how they are placed on display within the home. The intended outcome of this goal is to understand this use, which would allow us to speculate on the suitability of these items within the SOUVENIRS concept.

Goal 3: Gather reactions of families to the use of SOUVENIRS in the home. We want to learn how families might consider using SOUVENIRS; what kinds of photos they might link, what objects they might use, or how they might use the system to share photos with others. We also want to see what families liked about the system, as well as what changes or additions to the system they might suggest. The intended outcome of this goal is feedback to help us evaluate SOUVENIRS and generate design ideas for revising the system.

4.2 Participants

Our study results were gathered from 20 participant homes within the city of Calgary, Canada. Participants were recruited by email from lists of homes that participated in prior domestic studies conducted by our research lab. The homes were selected to span a range of lifestyles

that included a variety of occupations (e.g., dentists, graduate students, bank managers, etc.), household sizes (ranging from from two to six members), and ages (from teenagers to adults in their 50's). Children under 14 were not interviewed due to ethical concerns in dealing with minors.

The selection of participant homes was intentionally biased toward families (rather than singles or casual roommates) in order to obtain the most relevant results with regards to within-home photo and souvenir practices. We believed that families would be more likely to share photographs within the home, and also that their shared collection of photos would be relevant to all family members (i.e. the "family photos"). Thus, family households were selected consisting of couples without children, or families with as many as two children and included as many as two grandparents. Additionally, participant homes were selected where at least one family member took digital photos on a regular basis and stored photos in the home.

When scheduling homes we tried to find times where all family members would be available to participate. While this was not possible in some cases, most of our sessions did include all family members.

4.3 Contextual Interviews

Our study methodology was based on semi-structured contextual interviews. As described by Beyer and Holtzblatt [Beyer and Holtzblatt, 1998]:

> "*Contextual techniques are designed to gather data from customers in the field, where people are working or living. Contextual Inquiry is a field data-gathering technique that studies a few carefully selected individuals in depth to arrive at a fuller understanding of the work practice across all customers.*"

For our study, interview sessions of approximately one hour in duration were conducted within the homes of participant families. During these sessions we asked families about their

photo and souvenir management and sharing practices, and received a tour of the locations where photos and souvenirs were displayed or stored. The interview and touring sessions were semi-structured in order to be opportunistic. We often used our questions to probe participant's actual context, asked if we could be shown a particular collection or display as it came up in the interview, or were able to interview participants about collections or displays as we came across them in the tour.

Contextual Inquiry typically involves researchers observing work practices as they are happening. However, in our case it was infeasible to schedule interviews in order to directly observe photo and souvenir collections being organized and shared; organization is typically an ongoing process and may be infrequent, and the sharing events we are most interested in are often serendipitous. Despite this, there were several benefits to conducting the interview sessions within the context of participant homes. We were able to gain a first-hand view of where participant collections were stored and displayed within their homes without relying on participant descriptions of these areas. Also, in being shown the collections we became involved as observers in a sharing event, and while these were artificially caused it is likely that real sharing events would involve similar actions. Additionally, participants could discuss their collections in place rather than having to recall descriptions from memory.

4.4 Procedure and Guiding Questions

The interview process was organized into three stages addressing each of the study goals: print and digital photos *(goal 1)*, souvenirs and mementos *(goal 2)*, and system demonstration *(goal 3)*. The procedures for each stage of the study are described in the following subsections. Guiding questions were used to lead the discussion in each stage of the study; a listing of the questions for each stage is shown in Table 4.1. These guiding questions were used to ensure relevant topic areas were discussed (see Table 4.1); however, the interview process was semi-structured in order to follow up on and explore the individual practices and opinions as they

Stage 1: Print and Digital Photos

- How long have you had the camera
- Who uses the camera and how often/why
- What kinds of pictures are taken/why
- How, where, and when are photos displayed/why
- How do you find a photo
- How, where, and when are photos shared within the home/why
- How, where, and when are photos shared outside the home/why
- Who do you share photos with
- How do you choose who to share with and what
- Who shares with you and how
- What memories are associated with the photos
- What works best about the way you manage and share your digital/print photos
- What challenges exist about the way you manage and share your digital/print photos

Stage 2: Souvenirs and Mementos

- Who collects souvenirs or mementos
- What kinds are collected
- How, where, and when are the souvenirs displayed/why
- Do people ever comment on them
- What memories are associated with the souvenirs (people, places, or events)

Stage 3: System Demonstration

- What activities could you see yourself and your family using the system for/why
- Who would you use the system with?
- What do you think the system would work best at doing/why
- What do you think would be challenging about the system/why
- What do you think the system cannot do that you would like it to/why
- What would you change in the system if anything/why

Table 4.1: Guiding questions for contextual interview process

were expressed by participants, and to take advantage of the opportunities that arose as they showed us their home and its artifacts.

4.4.1 Stage 1: Print and Digital Photos

To satisfy our first goal, we investigated domestic practices around print and digital photos. We began interviews by asking families about their photo taking practices. This included information such as: how long they have had their cameras, who uses the cameras, and what the cameras are typically used for. Following this we discussed what was done with the photos - how they were stored, displayed, and shared. During this time we would be shown or would ask to see, with the participants permission, the various collections and displays in the home. This typically included photo albums or framed photos in the case of print collections, or photos kept on the computer in the case of digital collections. The interview process was opportunistic - we would inquire about particular collections as they came up in conversation, or as we came across them in touring the participant homes.

4.4.2 Stage 2: Souvenirs and Mementos

To satisfy our second goal, we investigated domestic practices around souvenirs and mementos. We asked who collects souvenirs and mementos, and what kinds are collected. Similar to Stage 1, we then asked to see the various places where these items were stored or displayed. We inquired about the various collections as they were shown to us, including why particular locations were selected, what memories were associated with the various souvenirs, and how these items might be shared with guests.

4.4.3 Stage 3: System Demonstration

To satisfy our third goal, we wanted to gain participants' reactions to the SOUVENIRS prototype as described in the previous chapter. We used a video demonstration of SOUVENIRS to introduce the idea to participants. The video aimed to provoke participants' speculations on

the system, as opposed to a judgment. A storyboard depicting key frames from the video is illustrated and annotated in Figure 4.1. The story follows three friends discussing a recent trip, where one brings up photos of that trip via a souvenir shotglass (frames a-d). Another set of photos from a wedding is then triggered using a print photo (frames e-f). Finally, the video demonstrates how a set of photos are linked to a tagged object (frames g-l). Following the video demonstration we asked participants to discuss and voice their thoughts on the system, including ideas on how it might be used or changed.

Our methodology in using the video demonstration is somewhat similar to that of a technology probe [Hutchinson et al., 2003]. The video presented a novel system with simple functionality - the ability to link digital photo sets to tagged objects - that was intended to guage how participants might use such a system. However, technology probes require the installation of a functional system within participant homes in order to observe how the system is used in context. For SOUVENIRS, this requirement was largely infeasible; the infrastructure requirements for the system (large display with a computer attached, placed in a public area) would be costly and difficult to install in participant homes. As well, in order to use the system participants would have to temporarily change their digital photo management practices, which they may be reluctant to do because of the effort involved. The advantage of a video demonstration is that we could introduce the system and engage participants in discussion about how they might consider using or changing SOUVENIRS without the overhead involved in installing a true technology probe.

The drawback is that participants could only speculate on what they might do with the system, rather than being allowed to develop a routine around actual use over time. However, by introducing the video after already discussing the families' practices with photos and souvenirs, we believed that families would be able to reflect on SOUVENIRS with their current practices in mind.

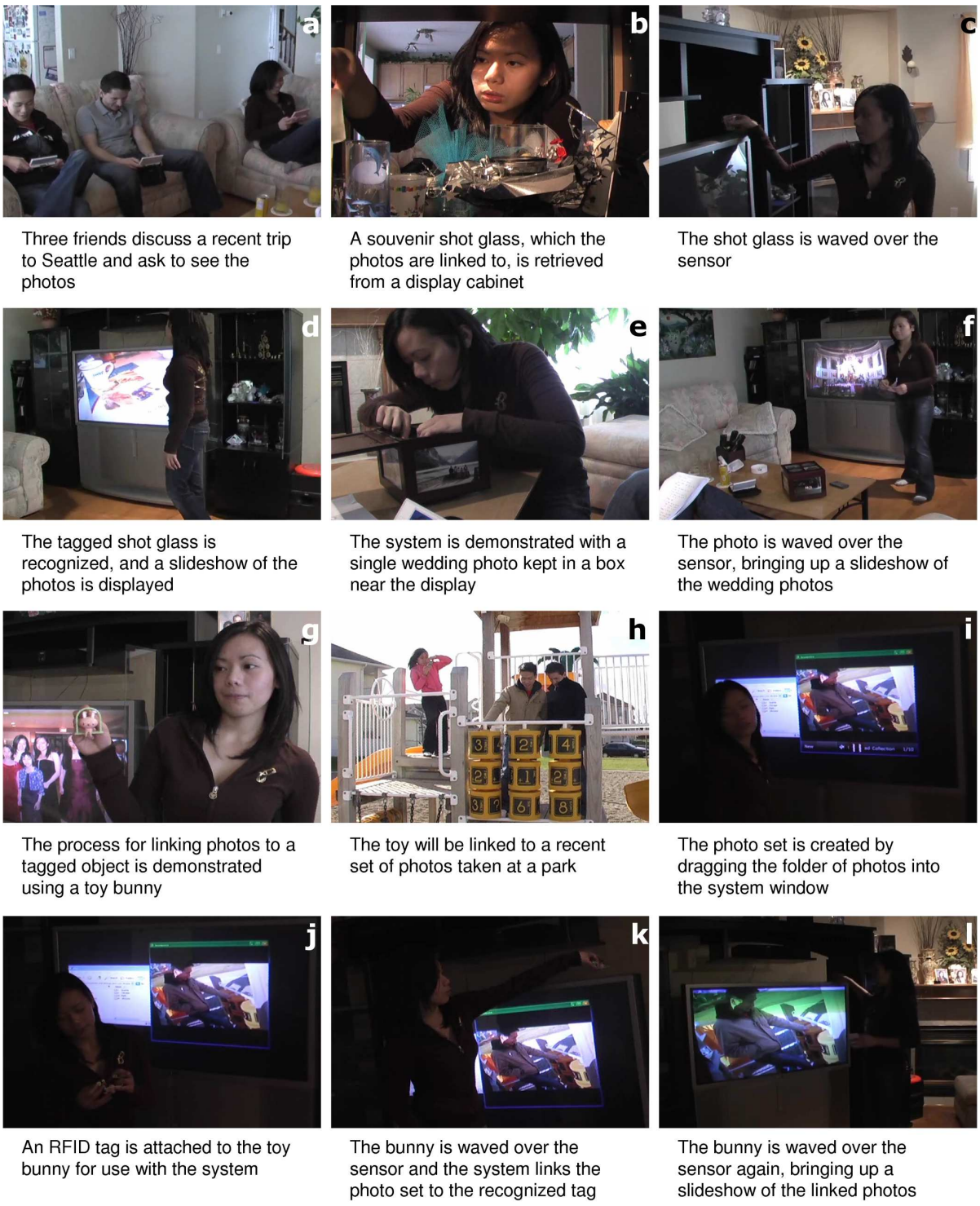


Figure 4.1: Storyboard for the SOUVENIRS system demonstration video.

4.4.4 Procedure and Data Collection

The overall interview process took approximately one hour. We began by giving a families a brief description of the study procedure, and of the various topics that would be covered. Stages 1 and 2 were often interleaved as they involved opportunistic discussion of collections as they were found when touring the home. Stage 3 was always performed last as it involved gathering the family to watch the demonstration video on an available television/DVD player.

Data was collected through field notes, digital audio recordings of the interviews, and digital photographs taken of the various souvenir and photo collections we were shown. A second interviewer, Dr. Carman Neustaedter, was enlisted and present at all interviews to help observe the interviews and to help in managing data collection; this minimized disruption of the interview flow.

4.5 Preliminary Study

Prior to conducting the interview sessions for the 20 participant homes used in our data analysis, we ran a pilot set of interviews. These pilots served to provide us with some initial data and allowed us to refine the interview process. These interviews were conducted in conjunction with Jeni Lynn Vito, a student at the University of Calgary, as a second interviewer. In total, participants for the preliminary interviews were recruited spanning 8 households. While the data gathered from these pilot interviews are not included in our analysis, they were useful in revising the interview process and in refining the guiding questions used for the main interviews.

Specifically, the decision to select only family homes for the main study was motivated by the pilot interviews, which had included households with roommates. We found that the data was less relevant in these cases. There was less desire to share photos within the home, and as the homes were seen as temporary there was less effort placed into creating displays or keeping collections of photos or souvenirs. Also, the guiding questions used in the pilot interviews

focused largely on the organization of photos, and as such the results mainly concerned the mechanics of how photos had been managed. That topic of photowork has been covered by other researchers [Kirk et al., 2006], and is not the primary focus of our research, which is more concerned with the effects of digital photo management on in-home sharing. Consequently, we revised the guiding questions to focus more on the difficulties and advantages participants experienced with various photo management and sharing strategies.

4.6 Analysis

Analysis of the data collected through field notes and audio recordings of the interviews was performed using the open coding technique [Strauss and Corbin, 1998]. Codes were initially generated and categorized in a way that loosely corresponded to the guiding questions asked. A listing of the raw codes and their descriptions is given in Appendix B. The codes were generated based on participant responses throughout the interviews. For example, if a participant family described showing print albums to share photos in the home, a new code, [Show Album], would be generated and added to the list of codes describing that families' photo sharing strategies. The code would then be reused in analyzing subsequent families reporting the same behavior.

The result of the coding process was a large number of codes, reflecting the observation of a large variety of practices, routines, and opinions held by the members of the participant homes. To make sense of these codes, following the open coding process we used an affinity diagramming process [Holtzblatt et al., 2005]. This process helped us to generalize the data and pull out salient themes, e.g, where numerous codes had been generated relating to a particular question or discussion point. An illustrative example of a finished affinity diagram for souvenir types is shown in Figure 4.2. The affinity diagramming process involved writing out all the codes related to the point in question, and spatially grouping them where codes appeared to be related or similar. Once the groupings had been created they were given headings that described their general theme (Figure 4.2, red text), and were optionally given some descriptive

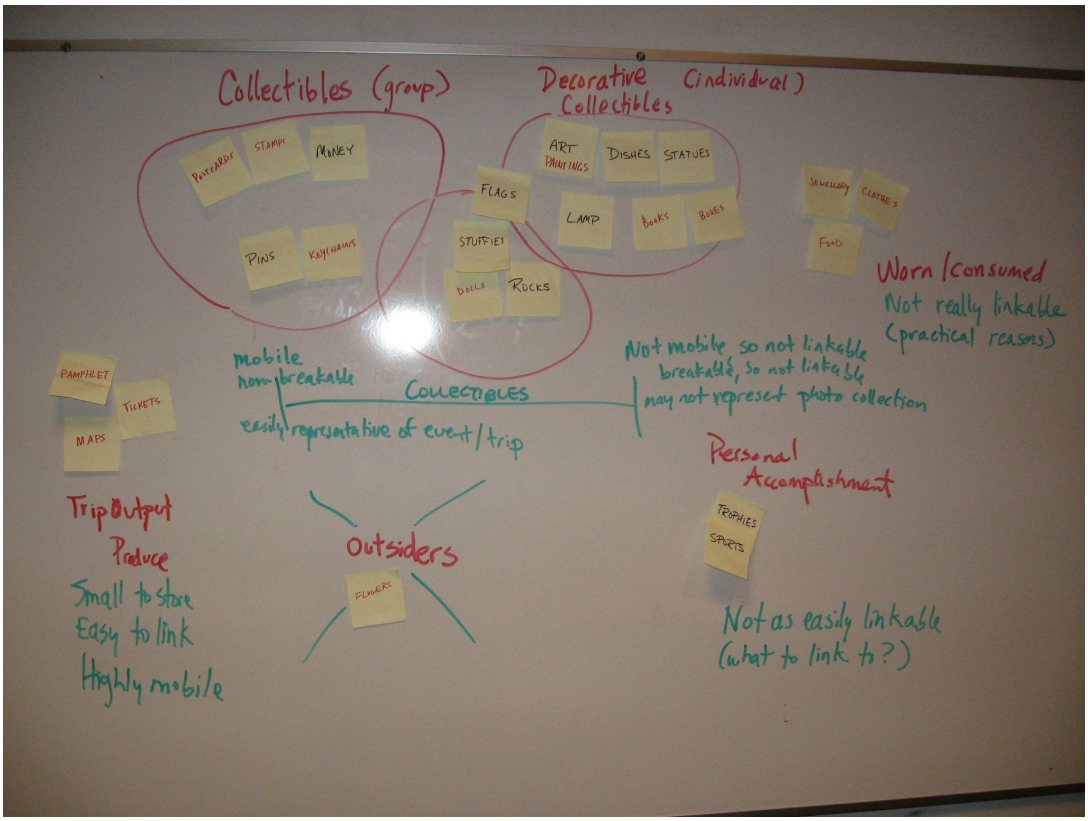


Figure 4.2: An example affinity diagram illustrating various souvenir categories.

text where warranted (Figure 4.2, green text). The groupings that emerged from the affinity diagramming process form the majority of our analysis that will be discussed in the following chapters.

Data analysis was performed in conjunction with Dr. Carman Neustaedter, who had been present for the interview process. As a large amount of data was collected covering several topics, Dr. Neustaedter performed coding with regards to the souvenirs and system demonstration stages *(Stages 2 and 3)* in order to expedite the coding process. Dr. Neusteadter was also involved in the affinity diagramming sessions as the process involves discussion and argument in creating the various groupings, and as such is ideally performed by a team.

4.7 Summary

In this chapter I described the methodology we used to conduct a study investigating current domestic practices around storing, sharing, and displaying photos and souvenirs in the home. By investigating these practices, we aim to build an understanding that will help critique and perhaps alter the design of our SOUVENIRS system. In the next chapter I will discuss the results of our analysis, which will be organized corresponding to the three stages of the study: print and digital photos, souvenirs and mementos, and system demonstration.

Chapter 5

Print and Digital Photographs in the Home

In the previous chapter I described the methodology we used in conducting a study to investigate how photographs and mementos were stored, shared, and displayed within the home. The intended outcome of this study would be an understanding of current practices families have built around these items, which would be used to critique and/or extend the design ideas present within SOUVENIRS. Over the course of the next three chapters I will discuss the results of the study. The chapters will divide the discussion to correspond to the three stages described in the methodology; print and digital photographs, souvenirs and mementos, and system demonstration. In this chapter I will give a detailed presentation of our findings of the first stage: print and digital photographs.

In presenting our analysis, we distinguish between print and digital photos by the form in which a particular photo was kept in the home (i.e. on paper vs on computer) rather than by source format (i.e. taken on film vs digital camera). For our purposes, we found the source format was largely irrelevant; the final form of a photo dictated how it was kept and used. Families who routinely made print copies of their digital photos kept these copies in much the same way as they had kept print photos from film cameras, and often only had a rough idea regarding how particular photos had been taken around the time of the switch. Similarly, families who had undertaken the effort to scan older print photos would also manage them in the same manner as they managed their other digital photos. While the processes used to get the photos into their final form may have changed in these situations, our primary concern for investigation was how photos were stored, displayed, and shared rather than how families prepared their photos to be used in these ways. This is not to say that film and digital photos are otherwise identical. Echoing what other researchers have noted about people's switch to

digital cameras, participants reported an increase in the number of photos taken due to the elimination of film processing costs, that they had begun to take multiple photos of similar shots [Jaimes et al., 2003, Kirk et al., 2006], and that seemingly mundane or playful everyday shots were deemed worthy of a photo [Kirk et al., 2006].

The discussion of the results for print and digital photographs will be presented in three subsections; 1. organization, location and accessibility, 2. how and why people share photos, and 3. sharing and tangibility. The first subsection will give us insight into how photo collections are made available for sharing within the home, and illustrate how print and digital photos differ in this regard. The final two subsections consider the ways in which photos are being shared and how technologies support or affect these practices.

5.1 Organization, Location, and Accessibility

We now focus on how photo collections are organized, where they are located, and how they are made accessible to family members. We consider and contrast these three properties for both print and digital photo media. The first two properties, organization and location, discuss the ways in which photo collections are typically kept in the home. This discussion is relevant to the third property, accessibility, as it describes how photos are made available for sharing within the home.

With accessibility, we wanted to investigate if and how families shared the knowledge of their photo collections with one another. We asked who primarily organized the photo collections, and also asked and observed who knew about the photo collections. From their answers, we could determine how knowledge of the photo collections had been shared amongst the family members. Little or no sharing happens when only the people involved in organizing the photos could access them and knew how to find photos. Sharing happens when others knew about photos and how to access them as well. We speculate that the single-user nature of home computers typically means photo collections are kept in a private user account, thus we ex-

pected to see significant differences between print and digital photos in how shared knowledge of photo collections spread and how accessible these collections were amongst all household members.

5.1.1 Print Photo Collections

Organization. We saw print photo collections kept in one of two categories: organized vs. unorganized collections. The defining characteristic of an organized collection is that some effort was made to maintain the order of photos. The amount of effort ranges considerably. This can be a very involved process such as the culling and placing of photos into an album, or can be a lightweight effort such as simply maintaining photo envelopes in chronological order. We saw storage mechanisms for organized collections typically include scrapbooks or albums (Figure 5.1b), organized photo boxes for holding large quantities of loose photos (Figure 5.1a), or even photo envelopes kept in order. Typical strategies included organization by date, by event, or some combination of the two.

Unorganized collections, on the other hand, are characterized as photos that have been stored without efforts placed into maintaining their order. This may result from photos awaiting organization building up, such as the envelopes shown in Figure 5.2b, or photos that have become disorganized through usage and not being properly re-organized, such as the box of packed photos shown in Figure 5.2a. Storage mechanisms for unorganized collections tended to consist of loose or framed photos put away into storage, or of photo envelopes left unorganized, and were usually kept within some other container such as a box or drawer.

Clearly, organization is best viewed as a spectrum rather than a strict category. The level to which a particular photo collection is organized or unorganized can vary, and collections that may be referred to as unorganized were sometimes in nearly chronological order simply because that was the default order in which the photos were returned from the developer. Our findings with regards to the organization of print photo collections verify and are in agreement with photo archiving strategies noted by other researchers [Frohlich et al., 2002,

Figure 5.1: Examples of “organized” photo collections: a) photo boxes, b) photo albums.

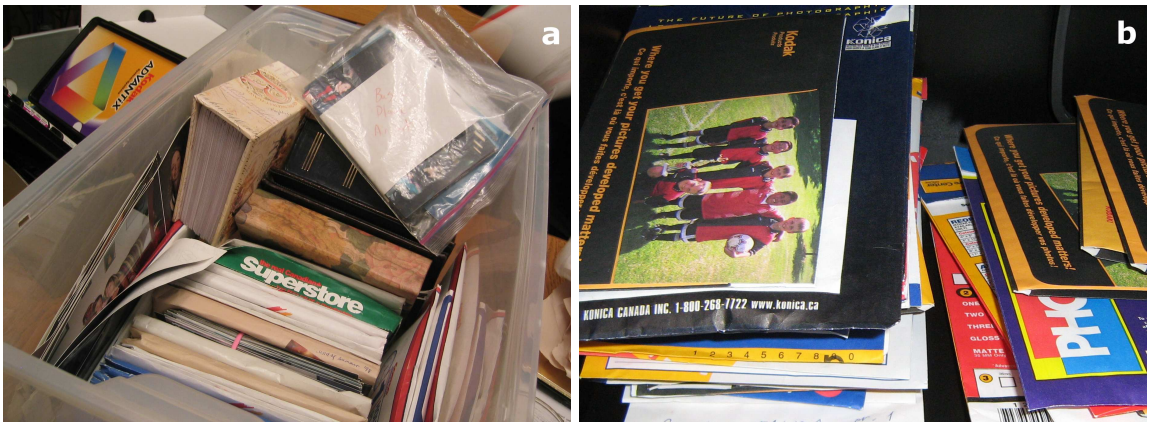


Figure 5.2: Examples of “unorganized” photo collections: a) packed up photos, b) envelopes awaiting organization.

Balabanović et al., 2000].

Location. We found that stored print photo collections were most commonly located on a shelf in either a living room or home office. However, other less frequent storage locations were noted including basements, bedrooms, guest bedrooms, and even parent’s houses, with the photos additionally being kept in cabinets, closets, drawers, or simply boxed in a corner.

When asked why these particular locations were chosen for storing their print photo collections participants often cited reasons of space management or pragmatics.

> *“They took up a lot of space, and we don’t have a lot of storage space. So, this is just where it ended up.”* - P4, Wife

Space requirements seemed to be the primary deciding factor for location: where there was available space, and where collections could be stored while avoiding clutter. For example, in one instance photo albums were collected on a shelf simply because “it’s a shelf”. Yet on reflection participants also added accessibility as a reason for their choice of location.

> *“[Because] it’s a shelf (laughs). That’s probably the most used room and when people come over you’re usually sitting in the living area somewhere...it’s easy and accessible to go and grab whatever.”* - P16, Wife

In the above example print photo albums were being kept on shelves in the living room. While the location might have been chosen because of the available shelf space, this arrangement has the side benefit of being near the area where guests are commonly entertained. Accessibility in this instance accounts for the ease with which family members could bring out photo albums to be shared.

Participants also offered several other lesser reasons for locating particular photo collections. Sometimes, photos were placed in a temporary location. This included the storage of photo envelopes waiting to be organized into albums, or photo albums that had been recently taken out to be shared with guests and not yet returned to their normal location. Another reason was archiving, where damage prevention was considered as a concern in photo storage.

Location also includes how and where photos are placed on display within the home. As expected, most framed photos are placed on walls or shelves. Less formal unframed photo displays (loose photos) might be placed on a fridge door. We most often saw photo displays in living rooms, but they were also common in hallways, bedrooms, dining rooms, kitchens and staircases.

We questioned participants as to why these display locations were chosen. Their reasons primarily concerned how the display fit in, where there was available space to display the photos in question, as well as pragmatic reasons such as the existence of a shelf or support studs in the wall.

"I thought this was a good spot. It's just for us, it's not for showing off, you know. I just thought this was a good spot for the size of the picture." - P1, Mother

This choice of display location based on available space may seem somewhat odd considering that this is a similar line of reasoning given for the choice of photo storage locations. With a photo display one might expect that visibility for others would be more of a concern. Yet we believe that people did not explicitly mention photo visibility, as this is so fundamental that it formed their tacit (and unstated) rational for photo display. In choosing an adequate space for the display, aesthetics, pragmatics and visibility all factor in; the space must be adequate both in terms of the literal size of the display and in terms of how it will appear to fit into the space.

Accessibility. When participant homes consisted of families with children we often observed that a primary organizer typically maintained the family print photo collection. This was usually one of the parents, commonly the mother. In some cases teenage children would be involved, although they usually only took a secondary role. While these collections were mostly maintained by a single person or small subset of the family, what was striking was that in most instances all household members were aware of them. From our interviews we observed that many of the family members had knowledge of the print photo collection and were able to discuss them. In the previous discussion of location, we noted that the family print collections, typically albums, were most commonly kept in the living room or a shared home office. These are common areas shared by the members of the household. In the case of the living room, the area is generally considered public to all family members and often used for entertaining guests. In the case of the home office, the area may not be readily available to guests, but is still an area frequented by household members. Because of this, the location of the photo albums allows them to be available and promotes shared knowledge of the family photo collections between family members.

Our participant homes consisting of new couples without children behaved somewhat differently. We noticed that there had been less time in which the participants had been able to

develop a routine around keeping a shared family photo collection. We saw that these participants often had personal photo collections that had been kept and maintained separately, and shared knowledge of these collections varied. One reason for the lack of shared knowledge may be that the photo collections maintained by each individual had been largely personal and perhaps less relevant to the other. However, we also saw in several instances that these photo collections had been stored in a manner that was essentially 'packed up' - stored in boxes or closets rather than having been organized into shelves. In instances where albums had been placed out into shelves - either explicitly stated as belonging to one person or not - we saw that participants did share knowledge of them.

5.1.2 Digital Photo Collections

Location. As might be expected, the majority of families kept their digital photo collections in folders on their computer. All but one family simply used the file system to manage and organize their photos rather than using an additional software system for photo management. The reasons stated was that the file system provided adequate features for their photo managing needs. Through it, they could get thumbnail views, start slideshows from the folder, and keep separate folders for photos in a manner similar to photo envelopes. Several families did note the use of secondary software, but this was usually for basic editing features or for uploading to online photo galleries rather than for organization.

Several people also stated that they preferred managing the files themselves as this allowed them complete control and knowledge over where and how the photos were being kept on disc.

We also saw that many families kept digital photos on physical media such as CD's or DVD's. In some instances this practice was taken as a primary storage method. That is, when the photos had been written to the physical media, they would be removed from the computer in order to conserve hard disc space or eliminate clutter in the file system. In other instances this practice would be used as a backup mechanism; the photos would be kept and accessed mainly from the computer hard disc, but periodic backups were kept in order to prevent loss.

In most cases the physical media was kept in home offices, near the computer.

Online storage (i.e., on an internet site as opposed to local computer) was also seen relatively frequently. However, this was generally not used as a primary storage for photo collections. Instead, only a chosen few photos would be uploaded from the main photo storage. In this case photos were uploaded to online photo galleries with the primary goal of sharing them, usually by sending links to friends and family, although photo gallery websites also allow the possibility of sharing photos within the general online community [Miller and Edwards, 2007].

Organization. Digital photos were usually organized using some scheme involving date or event or both. This reflects similar organizational practices as seen in print photo collections. As mentioned, storing photos into folders is somewhat similar to the use of photo envelopes - often participants reported that they would periodically download all the photos accumulated on the camera into a new folder, which would then be labeled as was seen fit. Thus, the contents of folders typically reflects camera downloading practices. Photos may be downloaded, and then labeled after specific events as seen in Figure 5.3a, or might just be downloaded periodically and labeled by date as seen in Figure 5.3b.

> *"In a way digital is nicer because you don't have to [sort and label them], you just save it and it's there. You don't have to manually go through and then put them [in albums]."* - P5, Mother

Accessibility. Digital photo collections were similarly maintained by a single primary organizer or subset in family homes. However, this was more commonly reported to be the father rather than the mother. As well, the shared knowledge accessibility of digital photo collections was much different from that of print photo collections. Most commonly, we saw that knowledge of these collections was limited to the primary organizer. Other family members seemed only to have a vague knowledge that the collections existed, but often did not know how to access them and were unsure of what was being kept.

> *F: [after showing Mom some folders containing photos] "Did you know that?"*

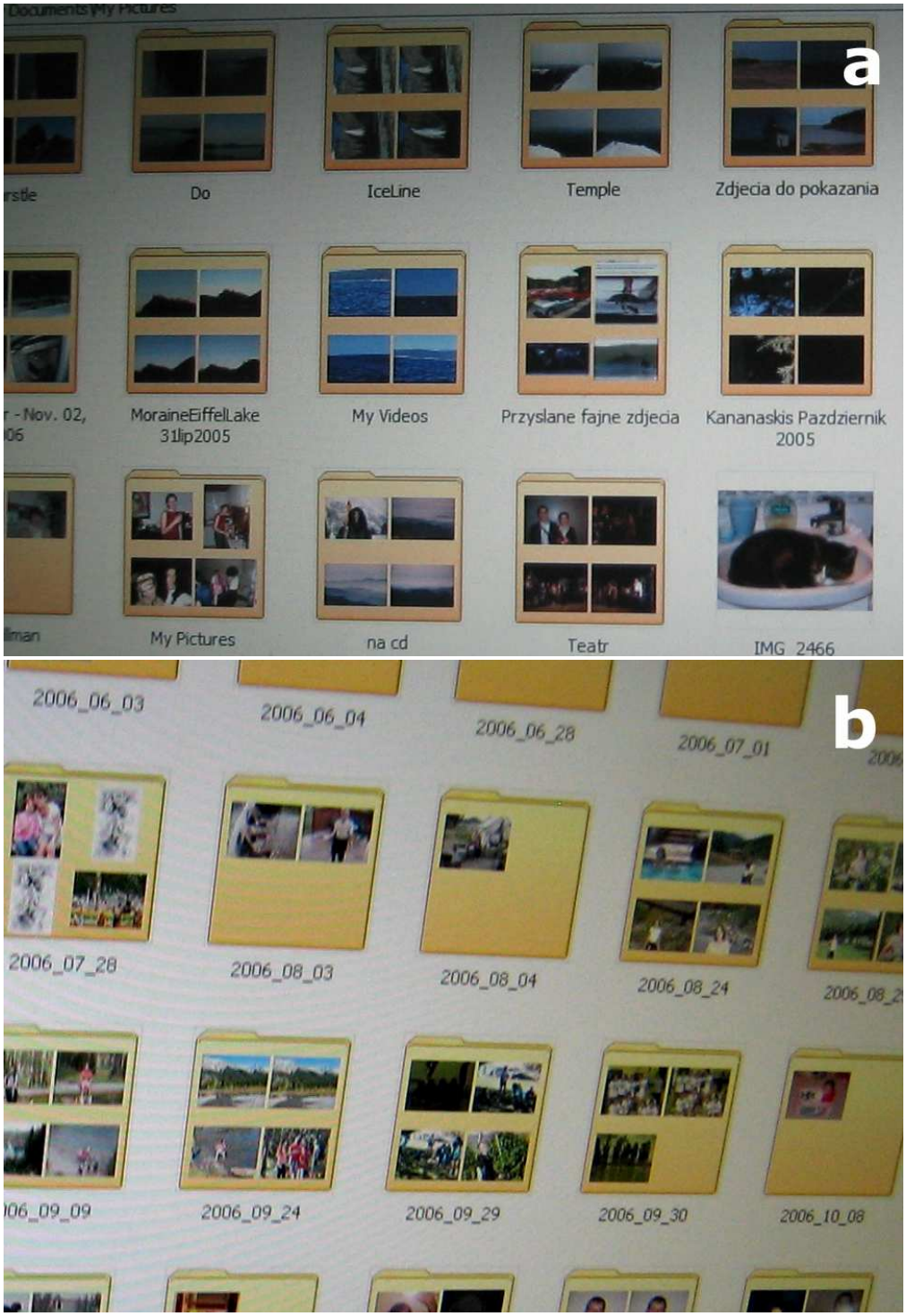


Figure 5.3: Typical digital photo organization strategies: a) downloaded and labeled after specific events, b) downloaded periodically and labeled by date.

M: "No, I don't use that, I don't know." - P1, Mother and Father

Even when participants knew a photo collection was being kept, there was reluctance expressed about accessing a collection maintained by another family member. This reluctance was because photos were managed under individual user accounts, or even computers, which were seen as private - belonging only to the owner.

"I'd use [my husband's] computer but it's his computer. I know his password but it's like his space. And my computer is my space." - P4, Wife

Because access to the digital photo collections was often limited, we saw that the primary organizer usually took on the role of a librarian for the family photos. If another family member wanted access to a particular photo or set they would resort to the social channel for access, relying on the primary organizer to retrieve the photos for them.

"I don't think they even know about the organization. Usually when they wanted some [photos] - like for her project, she'd ask 'Mom, can I have', you know, a picture of her in an occasion. And then I will find it and I will get her a copy." - P8, Mother

While access hindrances on digital photo collections were typical in the families we interviewed, we observed some exceptional cases where families had successfully taken measures to ensure that the digital photos were available amongst family members. In one instance, the family had chosen to manage the photo collection in a folder that was equally accessible from all accounts on the family computer, "`C:/photos`", rather than the typical account specific "`My Documents/My Pictures`" where photos are typically placed by default on Windows PC's. In this family the father typically handled downloading photos from the digital camera into folders on the computer. However, both the mother and child reported knowing how to find and access photos on the computer. Similarly, in another instance we saw a family that kept their photos together on a shared computer in the kitchen/dining room area. The

photos were organized and made available to all family members on this computer through the use of Picassa software. This strategy had a side benefit: because the computer was located in a public area the photos were immediately available for sharing with guests within the home. This family reported sharing photos regularly with no difficulty, where they used Picassa's slide show capabilities.

Summary. In this section we have discussed our findings contrasting organization, location, and accessibility of families' print and digital photo collections. While the means of storage are different (e.g. albums or envelopes for prints, folders for digital), the organizational strategies between the two appear to be similar - usually by event or by date. However, the typical locations for these collections have significant differences in accessibility. While accessibility may not have been the primary motivation in choosing a location for prints, they were typically kept in a place that is public and used by all family members. This is in contrast with digital photos, which are typically kept under the user account of the primary organizer - and is seen as private for that person. Through our interviews we saw that family members other than the primary organizer had knowledge and could access the print photo collections. On the other hand, there was little shared knowledge for digital photo collections, and usually access had to be gained through the primary organizer.

5.2 How and Why People Share Photos

In this section we will turn our focus to understanding current photo sharing practices in the domestic environment. The key discussion points that will be covered are as follows:

1. **How are photos shared?** Describes the methods typically used for sharing photos in the domestic environment.

2. **Why are photos shared?** Describes the typical motivations for sharing photos by observing why certain photos are shared with others, particular focus is placed on how the different

methods for sharing photos satisfy the motivations for sharing photos.

3. **Print vs. digital sharing.** Examines how current print and digital photo technologies are amenable to each of the methods, which in turn satisfy different motivations for photo sharing.

Our discussion of how and why photos are shared is focused on "home mode" sharing, which has been most notably studied in depth by Chalfen [Chalfen, 1987]. With our findings, however, we generalize the typical methods and motivations for sharing photos in the home and extend this by examining the role of current technologies in supporting these practices.

Through our interviews we saw three methods families use to share photos, we also saw that the choice of photos to share, and the people they are shared with, are motivated differently depending on the method. The three methods are:

1. **Displayed photos** are photos placed in visible locations within the home. Displayed photos are typically framed photos placed on shelves or walls throughout the home. Sharing via displayed photos is implicit; because the photos are visible, guests can view displayed photos without being shown them by an owner.

2. **Shown photos** is when a particular photo or set of photos is brought out by an owner to be shown to guests. Typical examples of this include showing albums of print photos, or slideshows of digital photos on the computer.

3. **Gift-giving photos** is when selected photos are given to the recipient. Typical examples of this include giving away duplicate prints, or sending digital photos via email. Gift-giving photos does not necessarily involve face-to-face sharing; recipients are free to look at the photos at their convenience.

These different methods were accompanied by different reasons for sharing the photos, each of which will be described following.

5.2.1 Displayed Photos

For *displayed photos* we saw that particular photos were chosen aesthetically rather than for communicative reasons. One mother explains how she has created a collection of photos to be displayed in the future:

> *"Everyone has their favorite ones that they want to print and display. In fact I have a bag of negatives because I think - this is just a rental property - but I think I'm gonna have a house someday, and I'm gonna want to blow this one up and frame it."* - P17, Mother

As seen in this example, participants often noted that photos were displayed because they were favorites; this was the primary deciding factor, as opposed to the photo's potential to evoke story-telling with guests. Aesthetic motivations are also echoed in the location of displayed photos - they are placed where they fit in and display well.

5.2.2 Shown Photos

For *shown photos*, we asked participants what prompted them to show particular photos and to whom they were shown. One father describes his typical photo showing practices:

> *"Just if we thought it would be interesting to someone else. Like if there are people we did sports with or hiked with - like camping or our mountain trips. Or if we're traveling somewhere - someone that's interested in hearing about the trip, we'd show."* - P5, Father

The answers in this case commonly included showing photos to others who were in the photo, or that a topic came up in the conversation, such as a particular vacation destination, which was related to the photos. In the next quotation a husband describes a recent photo showing:

> *"My buddy came over - we went to the car show and he didn't. So I was like 'whoa, you've gotta see the Shelby', so we went down to look at the pictures from the car show.*" - P16, Husband

In this example the participant knew his friend shared an interest in cars, and this prompted the photos to be shown. With shown photos sharing was typically motivated by social relevance - the particular person and course of conversation play a large role in deciding to share photos, rather than sharing some recent liked photos.

5.2.3 Gift-Giving Photos

For *gift-giving* photos we similarly asked what kinds of photos they gave to others, as well as what they received. A mother describes pictures the family has been given:

> *"My parents...anytime they take pictures they make us copies...and we get copies of our nieces and nephews or our kids that they've taken. Usually it's kid related.*"
> - P5, Mother

In the above example, pictures of nieces and nephews are given as status updates to relatives. Pictures of young children are frequently given as gifts as these display rapid growth and development. Another mother describes giving photos to relatives after having moved away:

> *"I was living in a resort at the time, so I was sending them to my family and sharing them with them in that way...I would send the scenic pictures because, of course, the mountains are so beautiful. And I would also send them, like if I had a friend I talked about a lot, I would send 'oh, this is...we work together' "* - P17 Mother

Again, we see that photos given as gifts are used as a status update given to distant or infrequently seen friends or relatives. Due to its distributed nature, gift-giving photos is well suited as a means to provide interpersonal awareness [Neustaedter et al., 2006] and was typically seen to be used for this purpose.

It should be noted that the above described correlations between the methods and purposes of photo sharing are not strict. For example, others in the photo might be given duplicates as a gift from a shared experience, such as a vacation. In this case the motivation behind giving the photos is closer to social relevance. In another example a photo album of a young child might be shown to guests, which resembles a social awareness motivation. While not strict, the correlations described represent the most common trends observed, and illustrate how different methods can be more suitable for different goals in photo sharing.

5.2.4 Print vs. Digital

The previous sections have detailed the methods families use to share photos and the purposes these methods lend themselves to. Of course, print and digital photo technologies have strengths and weaknesses making them suitable or problematic for different styles of photo sharing. Currently, print photos are most amenable for *displayed photos*. While digital photo frame technologies have been developed for displayed photos, they have not yet been widely adopted. In our interviews we encountered only one home with a digital photo frame; they described their use of this:

> *"Well we used it at Christmas when we first got it. And we actually think we'll take it with us the next time we travel - cause you can see the pictures a little better on that rather than on the digital camera...I think we probably would use it more if we were having a bunch of people over. But when it's just us, we don't bother plugging it in.*" - P9, Wife

Additionally, two families noted that the desktop background or a slideshow screensaver on a computer were sometimes used to display digital photos in the home. Still, the use of digital displays for photos in the home is limited: the expense of digital photo frames, power requirements, lighting conditions, and restrictions on where the display can be placed are factors that diminish the flexibility with which digital photos can be put on display.

On the other extreme, *gift-giving* photos is much more amenable to current digital technologies. Print photos can be cumbersome, and often costly to make duplicates and mail. Comparatively, digital technologies excel at distributed communication as they can be used to easily and instantaneously give digital photos to others. Participants often reported using email, photo sharing websites, and instant messengers to share their photos with friends and relatives.

Digital photos, as we have seen, are least adaptable for *displayed photos* in the home, which serve as a way to exhibit aesthetically pleasing photos. Interestingly, other researchers have noted an emerging culture, referred to as Snaprs, around online photo sharing websites such as Flickr [Miller and Edwards, 2007]. Within this culture, aesthetically pleasing photos dominate the choice of photos to be shared. A participant quoted by Miller and Edwards describes this [Miller and Edwards, 2007]:

> *"Most of the photos I post to Flickr are for the purpose of art. They're not for information sharing. I'm not motivated in that way. The only people I imagine caring about my family photos is my family."*

This culture uses distributed online sharing, similar to *gift-giving*, but the audience is typically unknown strangers rather than friends or relatives. While our research was primarily focused on family 'home mode' [Chalfen, 1987] sharing, we did note some participants who described being active within this culture. This culture has formed as a way to share digital photos motivated by aesthetics, where this motivation is difficult to satisfy with digital photos in the home.

Both print and digital appear to be relatively amenable for *shown photos*. In addition to traditional methods of showing print photos in albums, participants noted that they liked showing digital photos as a slideshow. Devices varied; they used laptop or desktop computers, televisions, and even the camera display itself. Yet in spite of these uses, dealing with the technology often became a barrier to actual sharing. One family describes their reluctance to show digital

photos:

> *H: "[Digital photos are] not as ready to hand."*
>
> *W: "Yeah, you're looking at ten minutes at the fastest to go downstairs and load up the computer, get your file out."* - P16, Husband and Wife

This example illustrates some of problems commonly reported in showing digital photos. Guests often must be brought to the computer, which is typically in an out of the way place such as a home office, causing issues as it slows down the experience. As well, there is often inadequate space and/or furnishings for guests to view photos comfortably. Also, the time spent getting the computer to display the photos (e.g. booting up the computer, finding the photos, loading the correct application) can be significant if sharing was unexpected. Similarly, if photos are to be shared on another device such as a laptop or TV there can be time spent setting up the proper connections or making sure the desired photos are on the device. In order to compensate for this, people often reported preparing digital photos when they were to be shown. This reduces the ad-hoc potential for showing digital photos. One family describes a recent photo showing experience:

> *W: "My cousin had a Powerpoint presentation of his vacation. (laughter) It was like three hours long. He drove all the way to South America on motorcycle, so it was like a seven month journey."*
>
> *I: "Wow. And so he had a three hour Powerpoint? Did he email it to you?"*
>
> *W: "No, he um..."*
>
> *H: "He presented it."* - P9, Husband and Wife

What is key in this example is that the photo showing event was pre-meditated rather than serendipitous, the photos were prepared in advance to be shown at a specific time. This was common, preparation was often reported as a difficulty in showing digital photos. This included

Photo Sharing Method	Most Common Motivation	Most Amenable Technology
Displayed Photos	Aesthetics/Favorites	Print
Shown Photos	Social Relevance	Print and Digital
Gift-giving	Interpersonal Awareness	Digital

Table 5.1: Summary of findings for how and why photos are typically shared in the home, and how print and digital technologies are currently amenable for sharing.

creating CD's or DVD's to show with a DVD player, copying photos to a camera memory card or a laptop, creating folders and selecting photos for slideshows, and setting up proper connections to a TV if used. Ad-hoc sharing was typically reported when showing the photos directly on the desktop or laptop computer they were stored on, however this still presented potential barriers in booting up the computer, and finding the photos to be shown. It is notable that while we asked to see participants' photo collections if they felt comfortable in doing so, families were enthusiastic about showing their prints and albums, most reluctance was observed in bringing up the digital collections for these reasons.

In this section we have described the methods participants used to share photos, and how these methods relate to different motivations for sharing. We have also described the roles that print and digital technologies play in supporting or hindering the methods for photo sharing. Table 5.2.4 presents a summary of the relationships described in this section between method, motivation, and technology.

5.3 Sharing and Tangibility

The previous section presented a discussion of the ways photos are shared in the home, and how current print and digital technologies are amenable to different styles of sharing. In particular we noted that *shown photos* were amenable to both. However, we saw that there is still a strong appeal for printing digital photos, and when print collections were kept they were often preferred for showing. This is partially explained by the technological issues described in

the previous section. A full account however, must also consider participants' preferences for tangible physical photos when sharing. Similar preferences for the tangible form of prints have been reported in prior research [Crabtree et al., 2004, Frohlich et al., 2002]; here we describe in detail the properties we found reported for the preference.

5.3.1 Easy Viewing

Easy viewing takes in to account factors in the experience of viewing photos as a tangible print. One daughter describes her desire to have prints of digital photos:

> *"I find that if I take any digital pictures I still want to print them. Cause, well for me anyways, I like to look at a picture rather than a computer."* - P3, Teenage Daughter

The preference for viewing print photos was often described in vague terms, such as being "relaxing" or "nice to look at". However, a common theme, which is expressed in this quotation, is the intrusive nature of computer technology on the viewing experience; participants reported that printed photos hide the technology that would otherwise be visible when viewing on a computer. This could include the physical appearance of the computer, the necessity of navigating a GUI in order to find and display photos, or the lower image quality when viewing on a computer monitor relative to a print. One situation people noted where minimizing the appearance of computer technology was particularly desirable is showing photos to older relatives who may not be comfortable or familiar the technology.

5.3.2 Easy Sharing

Easy sharing takes into account how tangible print photos are readily available for sharing. This can be seen as the flip side of the technological barriers in showing digital photos.

> *"If you want to show them to somebody it's harder, cause you have to bring them to your computer or burn a CD and take it to them. It's a bit more effort than just*

envelopes." - P4, Wife

In this example, the envelope of photos still has to be retrieved and brought to the person to be shown. However, there is no further preparation involved; the prints are always ready to be shared. Efforts in navigating to find the photos on the computer, invoking the correct application to view them, or selecting and placing photos on another media to be shared are avoided.

5.3.3 Socially Engaging

The tangible form of the photo album was reported to have a positive effect on the social engagement of families and friends when sharing photos within the home. One mother expresses this:

> "*I really like having them there to look at...just having it more like a book so you can socially sit and go through things with like my mom and friends.*" - P5, Mother

The above quotation, states that sharing with a photo album is a social activity. However, it is not clear why this might be seen as more social than showing the photos on a computer. This is hinted at in the following quotation:

> "*I really like to be able to grab something and hold on to it and look at it and pass it around. Where, the digital, you stick it all on a CD and it takes less space, but you don't do anything with them.*" - P16 Wife

A physical photo album can be held and passed around, and this ability actively engages those who are being shown the photos. Showing the photos on the computer may resemble more of a presenter and audience relationship, as those being shown the photos have no control and are less likely to become involved. Another social benefit of prints is reported by other researchers [Crabtree et al., 2004, Lindley and Monk, 2006], is that the arrangement when showing photos on a desktop computer prevents the presenter from seeing the reactions of those being shown the photos.

5.3.4 Location

Location takes into consideration the ability of a physical photo album to be moved to a natural gathering place to be shared. Digital photos on the other hand are strongly tied to the computer they are kept on, and thus the location of the computer they are on. It is only with a considerable effort that this might be overcome - for example, photos could be transfered to a laptop to be shown, or written to a DVD to be shown on a television. Still, physical photo albums offer the most flexibility in being transported to where they are desired.

> *"You've got to go to the computer right, you can't just go to the kitchen table with it. Which is where - we had my birthday party, remember, where'd everybody hang out? We've got all that space and all that space and everybody was just right here. Unless you have a laptop with wireless, which we don't have..."* - P16, Husband

5.4 Summary

In this chapter I have presented our findings with respect to print and digital photos in the home, which address Goal 1 of our study methodology. These findings describe the differences between print and digital photo collections in the way they are made available and support photo sharing in the home.

Our first discussion point looked at current organization and location strategies, and how they affect the accessibility of photos in the home. In our motivation for SOUVENIRS we speculated that the single-user nature of current personal computers discourages access and shared knowledge of family photo collections. Our results verified this: the primary organizer of the digital photo collection often acted as a librarian whom other family members had to go through for access. In contrast, the most common locations for print photos - on shelves in living rooms or home offices - were places accessible and used by all family members. Our design of SOUVENIRS attempts to mimic this by using the public space and shared objects in the home in order to overcome access restrictions commonly seen with digital photos.

Our second discussion point categorized and related the typical methods and motivations for sharing photos in the home, and looked at how print and digital technologies support the different types of sharing. Currently, prints are most suitable for *displayed* photos; digital technologies such as digital photo frames are being developed to address this, however these have not been widely adopted. Meanwhile, the distributed nature of *gift-giving* photos is well supported by current digital technologies. *Shown* photos provide an interesting area for the design of systems such as SOUVENIRS. This kind of sharing is socially motivated - such as topics that come up in conversation, or shared interests with guests - and appears to be amenable to both print and digital photos. However, when print collections exist, they are generally preferred as they are more readily available for showing. Our third discussion point explored this preference further by detailing how the tangible form of print photos had desirable properties for sharing.

Still, there is still a desire to show digital photo collections within the home; despite reported difficulties with showing digital photos and the general preference for prints, showing digital photos was still commonly reported. Thus it is viable to consider how digital systems might be designed to support this. This is particularly so considering that a benefit of digital photo technologies is that the number of photos feasibly kept is increased by eliminating the expense that would be required to print them all.

Chapter 6

Souvenirs and Mementos in the Home

In this chapter I will discuss our findings for stage 2 of our study, which looks at souvenir and memento collections. While prior researchers [Csikszentmihalyi and Rochberg-Halton, 1981, van den Hoven and Eggen, 2005] have discussed the topic of souvenirs, they generally focused on how these items are valued or used by their owners. Our research extends this by investigating families' souvenir and memento collections, around the following key points:

1. **What was kept?** What kinds of items comprised families' souvenir and memento collections? What size were they or how easily could they be moved?

2. **Where they were located?** Where in the home were souvenirs and mementos stored or displayed? How easily could they be accessed? Would they be noticeable to guests?

3. **What memories were associated with them?** Would the memories that these items were associated with be readily associable to particular photo sets?

These points are of key importance as they characterize how systems like SOUVENIRS are amenable to current domestic practices around physical keepsakes. As described in Chapter 3, our analysis involved an open coding process. In this case, we used the process to group souvenir collections we were shown by participant families into classes based on similarities with these key points. In turn, we could then discuss how each of the classes may or may not be useful with SOUVENIRS.

We identified four classes of souvenirs: collectibles, worn/consumed, personal accomplishment, and trip output. This chapter will be divided into four sections describing each of these classes. It concludes with a discussion summarizing how these classes relate to SOUVENIRS.

6.1 Collectibles

Our first class, *collectibles,* represents the most typical kind of souvenir: items that are representative of places or events. Examples of these items include postcards, pins, statues or dishes. This class contained the largest variety of objects by far, and can be further broken down into two sub-classes: *individual collectibles*, and *group collectibles*.

Individual collectibles are one-off items that are usually represent a trip or event. These items are often decorative or artistic - such as a painting or statue - and are often kept on display, an example of which is shown in figure 6.1. They are usually selected as they convey an image reminiscent of the place or event they represent. One participant describes several of the individual collectibles on display:

> *"It's a bouquet of tulips. That would represent our trip to Holland because Holland is known for their tulips. And the reef shark there represents our trip to Fiji because we saw a lot of reef sharks...the digeridoo, you look at it and you automatically know it is from Australia...at least I do.*" - P11, Wife

Group collectibles on the other hand, are sets of items of a particular type that the collector has an interest in obtaining. Examples of these would include pins, coins, or other collections of like objects. These are typically obtained on trips that the collector went on themselves; this differentiates them from other hobby collections, although there may be some overlap. Figure 6.2a shows an example of this where a family has gathered and painted a collection of rocks from various hiking trips. In other cases, some of the items could be gifts from friends who knew the collector was interested in a particular item; such is the case in Figure 6.2b where some of the collection of pins had been received from friends.

> "*My husband especially likes to collect stuff. He wants to do a map and have a coin from every country.*" - P3, Mother

Figure 6.1: Example of individual collectibles displayed in the home as a public artwork.

We found that the locations chosen for collectibles was largely motivated by pragmatic reasons, such as where there was adequate room to display or store the items, or by aesthetics, such as where they fit in with the decor of the house. The type, *individual* or *group*, played a role in how the item was located. *Individual collectibles* consisted mainly of decorative items, and as such were often placed on display. The availability of adequate space to display the item would restrict where the item could potentially be placed, and was a consideration. However, because these items were on display the choice locations for these tended to be aesthetically based - taking into consideration where participants thought the item looked good. The considerations for locating displayed souvenirs echoes the choice of locations for displayed photos as described in the previous chapter. An example of displayed individual collectibles is shown in Figure 6.1, where the items are displayed as a public artwork.

Group collectibles on the other hand are often kept together as a collection, and tend to be stored rather than placed on public display. Thus, for these items the choice of location is

Figure 6.2: Examples of group collectibles: a) painted rocks displayed on a fireplace, b) collection of stored pins.

mainly pragmatic - they are stored where there is adequate room to keep them all together. An example of this is the collection of pins shown in Figure 6.2b, which are kept in a box stored in a desk drawer. While *group collectibles* were most commonly kept in storage, there were instances where collections were placed on display - such as the rocks gathered from hiking trips and painted as displayed in Figure 6.2a or the showcase of collectibles placed on display in Figure 6.3.

Much like displayed photos, the choice of location for displayed collectibles did not appear to be primarily motivated by visibility to guests. However, families did note that the displayed items did serve as conversation pieces. Often in touring the house to show us the displays they

Figure 6.3: Showcase of collectibles

began to recall and tell stories relating to them.

> *"When you walk into someone's house and you see something that you know is from somewhere, that's gonna start a conversation too. We got a map out there that I got framed from when [my husband] went to Fiji...that's a conversation piece. People say, 'where did you get that?' "* - P11, Wife

6.2 Worn/Consumed

Our next class of mementos, *worn or consumed*, includes items such as clothing, jewelery, or food that were acquired on trips and are representative of or unique to the place they are from. For example, one father told us how he would routinely bring back chocolate from his travels, as he found chocolate differed between region or countries. Like collectibles, these items were representative of the place they were from; however, they were purchased for a more practical

Figure 6.4: Personal accomplishment: basketball trophies displayed on a teenage child's shelf.

reason - to be worn or consumed. As such, these items would not be suitable for linking with photos with SOUVENIRS.

6.3 Personal Accomplishment

Personal accomplishment mementos are items that commemorate personal achievements in activities such as sports or musical performance. Items in this class typically include trophies, medals, or certificates. These items were commonly displayed; e.g., placed on shelves or framed on walls. In some instances they are displayed in public areas of the home, such as the living room. However, because they are personal they are also often kept displayed in a personal space, typically a bedroom. For example, Figure 6.4 shows a display of basketball awards kept on a shelf in a teenage child's bedroom.

6.4 Trip Output

The final class of mementos, *trip output* is comprised of items that are gathered as a result of a trip, but unlike collectibles are not deliberately purchased as a souvenir. Instead, they

Figure 6.5: A collection of trip output that has been stored in a basement.

are accumulated as a result of planning and carrying out the trip. Typical trip output includes items such as tickets, maps, or pamphlets. An example of these is shown in Figure 6.5. Trip output items are often not immediately thought of as souvenirs although many families kept collections of these items to recall memories of the trips they were from.

> *"I think I collect everything. I keep ticket stubs, receipts, brochures, and sugar packages...Originally it was because of the scrapbooks because I knew I'd have a way to save them all. And I guess it just invokes more memories of the vacation...sometimes they're funny or interesting."* - P7, Mother

Trip output typically consisted of many small items that were neither decorative nor practically useful in the home, and thus they were usually kept together in some out of the way

storage - such as packed in boxes kept in basements or closets. For example, in one household a husband and wife kept a box containing all their trip output from band trips in their basement. While these items may not be practically useful and are often seen as clutter, participants noted that they could not bring themselves to throw them away because of their associated memories.

Although trip output was usually kept in storage, the small size of these items meant that they could be kept along with print photos. In some cases participants noted that they enjoyed keeping some of these memorabilia items alongside their related prints. This was done by creating scrapbooks, or simply keeping the items in a photo album dedicated to the trip.

> *"I like the...albums because I can put all the other little stuff that I keep, like tickets and posters and pamphlets and stuff, I can put them right in with the pictures."* - P4, Wife

> *"For one trip I took I stored things in a scrapbook, and I liked that because then I could also keep tickets and brochures and things - other things in the same place as the photos."* - P9, Fiancee

6.5 Discussion

In this chapter I have presented our classification of the types of souvenir and memento collections we saw in participant's homes. Four classes are described: collectibles, worn/consumed, personal accomplishment, and trip output. Each of these have properties that allow us to speculate what the opportunities or concerns would be in using this items as a physical interface for linking to digital photos with SOUVENIRS.

Individual collectibles appear to be the most immediately promising for linking to photos. These items tend to be placed on display, often in areas used for entertaining guests. Because these items are often strongly representative of the places they are from, they can become conversation pieces that in turn could lead into serendipitous opportunities for photo sharing.

Yet these opportunities are tempered by several factors. The first is mobility. Some items are small and robust, so they could easily be brought to a sensor. Others are heavy and fragile, which makes moving them to a sensor problematic. The second is location. While collectibles are often located in areas for entertaining guests, they could also be located in other private or less convenient places around the house. If a desired collectible is not nearby, it would have to be retrieved for use with the system.

Group collectibles and trip outputs as typically used are not as amenable for linking. These items are often kept out of the way in storage. As well, group collectibles might include items given as gifts, so there would not be a related photo set. However, the grouped nature of these items suggests an interesting possibility for families to use them with the system. Families may store such items out of the way simply because they have no practical and immediate purpose. Yet, these items are small and tend to be kept together, and thus could potentially be kept in a collectible or trip output box in a convenient place for use with the system. That is, the culture of how group collectibles and trip output are stored may change if systems like SOUVENIRS were available.

Personal accomplishment may seem like an obvious fit to SOUVENIRS. For example, a medal for performance in a race might intuitively link to photos from that race. Yet, certain mementos may be too general to link to a specific set of photos. For example, a trophy won at the end of a basketball season might be associated with several photo sets, e.g, photos from the season, photos from the winning game, or photos of the team. This confusion could cause difficulties for creating and remembering associations for certain items used with the system. When kept in personal spaces, e.g. a bedroom, personal accomplishments suffer the same location problem as mentioned earlier with individual collectibles.

6.6 Summary

We have presented a look at current practices families have around souvenirs and mementos in the home. Some classes of souvenirs and mementos will likely lend themselves immediately to photo linking, e.g., individual collectibles. Other classes are unlikely, such as worn/consumed collectibles. The current practices around the other two classes are a weaker fit for photo linking, but we speculate that the culture practices may evolve with the availability of a system like SOUVENIRS. While there may be some difficulties present in using certain items, there is still some promise shown for using others, and it is important to keep in mind that the design rationale of SOUVENIRS simply aims to provide an alternative method for accessing certain photos where it is convenient and desirable.

Chapter 7

System Demonstration

In this chapter I will present our findings for stage 3 of the study, which looked at participants' reactions to a demonstration of SOUVENIRS. As described in our methodology in Chapter 3, we showed participant families a video demonstrating the use of SOUVENIRS. Following the demonstration, we elicited their general reactions to the system: how they might consider the system useful, what problems they could foresee, and what changes they could suggest. The details of these reactions will be described in this chapter.

7.1 Positive Reactions

Participants reacted positively to the SOUVENIRS demonstration. In particular, they liked how it placed digital photo sharing within a social setting, and that it provided a way to share digital photos that hid the underlying technology. They were also interested in the possibilities for using physical and tangible icons as links to photo sets.

7.1.1 Social Setting

SOUVENIRS is designed to encourage digital photo sharing by situating it in a social setting within the home, and this was seen as an advantage by many participants. As hoped, they noted that the use of a large screen display would allow them to show photos to many viewers at once. They saw this as an advantage over showing on a computer monitor, and even over print albums. Also, they liked the fact that such a display would typically be in a living room or other area commonly used for entertaining guests. This allows the system to be ready nearby when photo sharing is desired, and also places it in an area that is equipped with appropriate space and furnishings for the comfort of guests. The following quote captures these sentiments:

> *"That's something I'd show friends. More friends can watch at the same time, not like an album where only a maximum of two people can look at an album. I think it's good."* - P1, Mother

7.1.2 Hides Technology

Another advantage to SOUVENIRS mentioned by participants is that the underlying technology becomes relatively transparent in comparison to current means for sharing digital photos in the face-to-face environment. One of the reasons for this is that the system would be always ready for photo sharing. Because the system would be kept connected to the display and ready to bring up photos when a tagged object was detected, it avoided potential delays in booting up desktop computer systems, or setup issues in connecting a camera, laptop, or other device to the TV to show photos. Additionally, by linking photos to tagged objects SOUVENIRS avoided the need to navigate through the file system to find photos for sharing.

> *"You don't have to sit down and try to find the picture you want to show friends, it's just there."* - P1, Father

> *"If you found an object to link it to or a picture it would be really easy to find an album. And because it is already connected to the TV or a big screen it is easier than connecting the camera."* - P9, Fiancee

These advantages in hiding the underlying technology were also seen as particularly beneficial for use with elderly relatives who may be unfamiliar and uncomfortable with current computer systems.

> *"Where it would be useful is for the parents and grandparents. If they could just do that to their TV. Never mind the issue of having to transfer all of the pictures over. Once it was setup then my parents could just wave an object."* - P7, Husband

7.1.3 Mementos as Tangible Icons

Participants were receptive to the idea of using memory evoking objects as physical icons as it presented a novel way to share photos - and they saw this as a playful and interesting technique that could be shown off to friends. Although it would only work with a certain subset of photos, some participants noted that displayed souvenirs or photos were seen as conversation pieces could be used to lead naturally into serendipitous photo sharing.

> *"It seems a lot more fun and interesting to have a symbol from the actual place rather than having to go on your computer and start clicking on folders. They are a lot more organized this way and there'd be more memories."* - P3, Daughter

7.2 Challenges and Suggestions

Participants also noted several issues that challenge how the system could be put in to use within the home. In particular, the system may not fit existing domestic practices, the system may not scale to handle many photo sets, associative items for linking to a given photo set may be hard to choose, and breaking or losing mementos will affect system use. These issues will be detailed in this section.

7.2.1 Fit to Existing Practices

Some participants stated that the use of physical mementos as a link to photo sets could be problematic if it did not fit in with the existing practices a family had developed with displayed souvenirs. This would be the case for some families where souvenirs were typically not placed on display for aesthetic reasons. While these families would be reluctant to change these practices if the system were available, they still noted the positive benefits to the use of the TV or large display for showing photos to others, a subset of the SOUVENIR capabilities.

> *"I would like it if all of the pictures that I had on the computer were on the TV and I could scroll them, have a remote, and look through them. That would be great.*

Linking them to objects would be trouble for me because I don't like to keep those kinds of objects...that part of it wouldn't work as well for me." - P13, Husband

7.2.2 Scalability

Scalability of the system was also a concern, as the perceived assumption is that the system encourages families to collect and display objects for linking to any photo set they might want to share. Three problems arise. First family members might have difficulty in remembering what item was linked to a photo set. Second, they may have problems finding the item even if they knew what it was. Third, the number of items required to link to every photo set could cause clutter, or simply be too many displayed in an accessible place. Families that took photos often and had large photo collections saw this as particularly problematic.

"You would have to remember to get something each time...after a while you'd need a large storage area beside your TV...I'd have to store a lot." - P1, Father

"The amount of pictures that we take, we'd have boxes of items, you'd be literally grabbing things from boxes. For us I think a big screen like that if you could hook it up to this [remote]. The biggest problem we have is crowding when we show photos, but to be able to put that stuff on to a bigger screen would be good." - P16, Husband

Because of this problem, participants often suggested that they might prefer to use a collection of easily stored smaller items, such as single photos or index cards, instead of large collectibles. This partially solves the problem as these items could be created afterward, even if no representative souvenir had been acquired. They can be kept together e.g., stacked in an index box, which would allow them to be easily stored near the display.

"I'd have a hard time finding and storing those objects. Where would I put them all? One picture for each set would work." - P2, Mother

However, a few participants noted that this solution might defeat the advantages of having a physical object as a link to photo sets. Because these items would not be displayed, the opportunity for serendipitous photo sharing would be removed, and instead they would only be accessed as a way to bring up a desired photo set. Also, an object such as an index card created after the event would not have the same personal link as a memory-evoking object relating to the event. As a result, some people argued that folders on-screen would be just as effective.

> *"The object thing is the thing I'd find hard because you want to have the objects close to your TV and stuff...I'd almost rather have folders where you could just touch, but we're not really souvenir-type people...I guess a box of cards would work, but if you're just going to do that you may as well have folders on the screen"* - P7, Wife

7.2.3 Associating Physical Items to Photos

Another concern arose around people's ability to associate physical items to photo sets. Some families said that certain photo sets may not be from any significant event or trip and thus it would be difficult to find an appropriate item to associate. People commonly cited family photos as an example of this. They said it would be desirable to have these photos readily available for sharing, but they would not be accessible through a linked souvenir.

> *"The only thing is it applies more to pictures from something special like maybe a party or wedding where you could have something that triggers the pictures. But with just regular family pictures it would be hard and sometimes you do take a lot of those pictures, and sometimes you do want to retrieve some of those pictures"* - P8, Mother

> "*For the Turkey trip, we could link that [points to an item brought back], but for family photos it would be trickier to find something.*" - P9, Fiancee

Another issue noted by several participants arises when one forgets the association between a souvenir and a photo set. A related issue is that other family members may not know that a particular displayed souvenir had been set up as a link. The problem of forgetting a link could also be confounded in the situation where a particular vacation destination had been visited more than once - it would then be difficult to remember which trip a souvenir from that destination actually represented.

> *"Over time you might forget what souvenir was attached to what group of pictures, especially if you went somewhere twice. Like if you went to Seattle twice and took two sets of pictures. It's a good way to remember but also not organized enough for me. I'd maybe just have a normal object, like a stick with a sensor, then you could write the date, time, and event name and then just put that over the sensor."*
> - P14, Daughter

7.2.4 Breaking and Losing Mementos

Finally, participants noted concerns over breaking or losing mementos used with the system. They felt that the need to move mementos to the display increased the risk that they could get lost or broken in the process. This was of particular concern for expensive or fragile items. Also, if the memento had become lost or broken, they expressed concerns that the linked photo sets would then become inaccessible.

> *"So what happens if you lose the object that has the tag on it? Do you lose the photos?"* - P1, Father

Of course, the photos themselves would not be lost as the implementation of SOUVENIRS does not remove the original files. Thus, even if the associated item is lost the photos can be accessed through traditional means (e.g., through the file system).

7.3 Summary

The system demonstration stage of our study revealed positive reactions for the use of SOUVENIRS in the home. Strengths noted by participants included allowing digital photo sharing to be set within a social setting in the home, and hiding some of the technological barriers that currently discourage digital photo sharing in the face to face environment. These strengths match some of the goals underlying SOUVENIRS.

There was positive interest in the use of mementos as links to photo sets. However, our initial system design focused on linking and retrieving photos only through these objects. As a result, using displayed mementos would be undesirable when people did not display these items, or when the number of mementos to display would cause clutter. Additional problems arise when a photo set does not naturally associate with any memento, or when associations are forgotten. Additionally, moving mementos increases risk of loss or breakage.

The issues presented in this chapter, along with the results from the other stages of our study, allow us to reconsider and revise the design of SOUVENIRS. As such, further discussion of these issues in relation to SOUVENIRS will be deferred to the next chapter, which will address these issues and present our revised design.

Chapter 8

Reflection and Souvenirs Revisions

The last three chapters detailed the results of a study we conducted with the intent of validating our design rationale behind SOUVENIRS, which led to suggestions for improving the system. Chapters 5 and 6 investigated families' current practices around their photograph and souvenir collections, which provided an understanding of the environment SOUVENIRS is aimed to fit. Meanwhile, Chapter 7 presented families' reactions to a demonstration of the system, which confirmed perceived strengths, as well as areas for improvement. In this chapter I briefly reflect on the study results, and then describe revisions made to the original system prototype as suggested by the results.

8.1 Study Reflection

Our study findings brought forth evidence that supported and added detail to the ideas present in our design rationale. Within this context, I briefly revisit aspects of the original design rationale, and relate them to findings of the study.

Social Setting. With SOUVENIRS we aimed to encourage photo sharing by situating it within a social setting. This premise was confirmed in the study. In discussing the general preference for showing photos with tangible prints, families noted social engagement and location as beneficial factors. Additionally, the social setting aspect of SOUVENIRS was noted as a positive reaction to the system demonstration, and was even seen as potentially advantageous over prints as it would allow more people to comfortably view the photos.

Technological Delays. We suggested that delays involved in managing the technology required to show a set of digital photos could become a barrier to sharing. Our investigations in how print vs. digital technologies are amenable to photo sharing verified this. When discussing

shown photos, it was noted that digital photos are not as readily available as prints. Where prints of a photo set existed, these were generally preferred for showing. Additionally, families noted that minimizing the appearance and effects of technology management when showing digital photos is a beneficial aspect of SOUVENIRS.

Shared Access. In the design rationale, we suggested that current desktop computing systems would deter shared access to families' digital photo collections. This too was confirmed in the study. In Chapter 5 we saw that both print and digital photo collections were typically maintained by one family member. However, while shared knowledge and access was not a problem for print photos, it was for digital collections. Indeed it was seen that photos were generally kept under the user account of the person who organized them. As such others may not be able to access them, and in some cases would not even know what was kept. But even when access control was not enforced by the system and others could potentially access the account (e.g. the password was known, or there was no password), the perception of the account as a personal space can be enough to make others reluctant to access it.

Opportunistic Sharing Through Tangible Mementos. We suggested that the visibility of displayed mementos in the home could be used to provide opportunities for photo sharing. However, it is difficult to verify that this would be the case with SOUVENIRS without deploying and observing how the system would be adopted in homes. Participants' positive reactions to the system focused on how the system overcomes difficulties encountered with current methods for photo sharing, and perhaps these benefits are more readily apparent than encouraging new opportunities for photo sharing. Yet, the study does provide evidence that the system could be used in this way. We noted that *shown photos* tended to be motivated by social relevance, e.g. topic arising in conversation. Building on this, some participants considered their displays of collected mementos as conversation pieces. Thus, it is possible to see how the transition from conversation around a displayed memento to photo showing could be made. Additionally, participants had positive reactions to the idea of linking memory evoking objects, as combined

they would provide more opportunity for reminiscing and storytelling.

8.2 Revised Souvenirs

For the remainder of this chapter I will discuss the features and implementation of a revised prototype SOUVENIRS. The goal of these revisions are to allow the system to fit in more easily with observed practices, and to address potential issues participants had noted.

8.2.1 Shared Sets

The first revision concerns how photo sets to be shared are created. Participants liked the idea of being able to easily show the photos they kept on their computer using the TV, but this raises the question of how photos get there to begin with. The original prototype assumes that people would manage photos on the computer connected to the public display. However, people currently manage their digital photo collections on their personal computers. A more flexible solution is required to support this option. People will likely prefer to use their personal desktop computer to do the photowork that goes into creating photo sets. Family members could then choose to share subsets of their photo collections through SOUVENIRS.

To address this, SOUVENIRS now works as a distributed system, allowing all family members to easily access and contribute photo sets for sharing. Details on how the distributed system works will be deferred to the implementation section. The *photo management view*, shown in Figure 8.1, allows people to contribute to the shared sets from their computer. This view presents an interface similar to other desktop photo management software, where people can create, rename, or remove sets, and see thumbnail views of the available sets. Sharing a set using SOUVENIRS is accomplished with the following steps, illustrated in Figure 8.2:

1. Invoke the *photo management view* (Figure 8.2a).

2. Create a new set (Figure 8.2b).

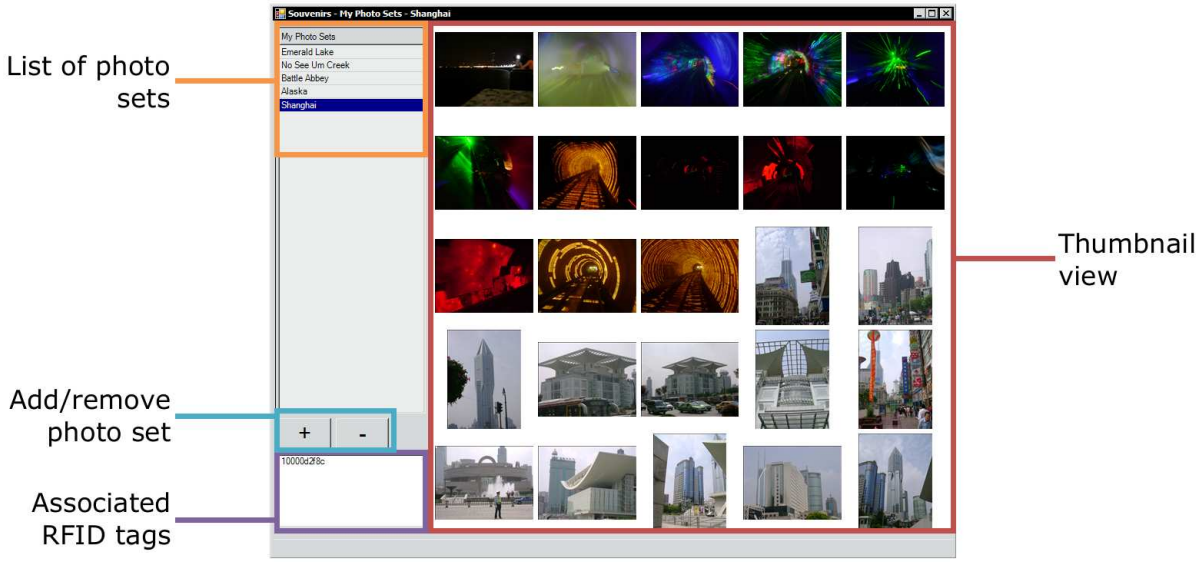


Figure 8.1: Overview of the *photo management view*

3. Drag the folder or individual photos into the window (Figure 8.2c).

4. Name the set (Figure 8.2d).

Once created, the photo set is available to all connected instances of SOUVENIRS running on the home network. Other family members will see this set in their *photo management view*, and the set is available to be shown on the large display.

Shared sets also includes the tags. A tagged object can be linked to the set using the *photo management view*; when an unused tag is detected by the sensor base it will be linked to the selected photo set. The RFID tag identifier will appear in the list of all associated tags for the set, which is shown in the lower left hand corner in Figure 8.1. RFID tag meta-data is also shared through the system; a slideshow of the associated photos can be invoked using the tagged object with any computer running a connected instance of SOUVENIRS.

8.2.2 Souvenir Linking Optional

Our original prototype only allowed slide shows to be invoked using associated mementos. This is an unreasonable restriction. Our participants thought it impractical to require a me-

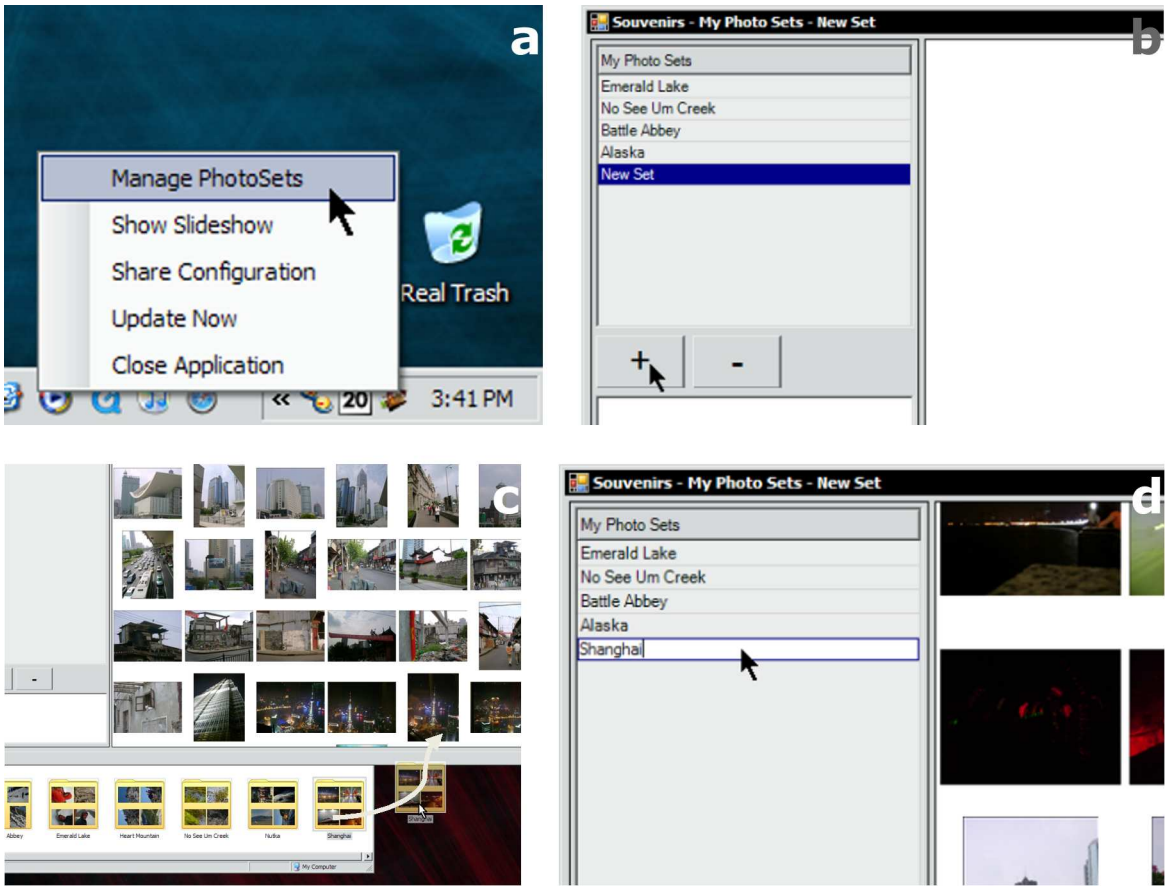


Figure 8.2: Creating a photo set using the *photo management view*: a) invoking the view, b) creating a new set, c) dragging photos into the set, d) naming the set.

mento to be kept for every shared photo set. In this revision, souvenir linking is now optional. Families can choose to use souvenir linking as much or as little as they desire. This helps incorporate cases where mementos are not routinely displayed, the number of photo sets would encourage too many mementos to be displayed, an appropriate memento for linking was not available, or when a linked memento had been lost or forgotten.

To accomplish this we augment the slideshow software with a collection view, as shown in Figure 8.3, as an alternative way to invoke slideshows. Somewhat similar to traditional photo viewing systems, this view allows on-screen navigation of photo sets shared through the system, where it provides a list of named photo sets with a preview of four thumbnails. Users

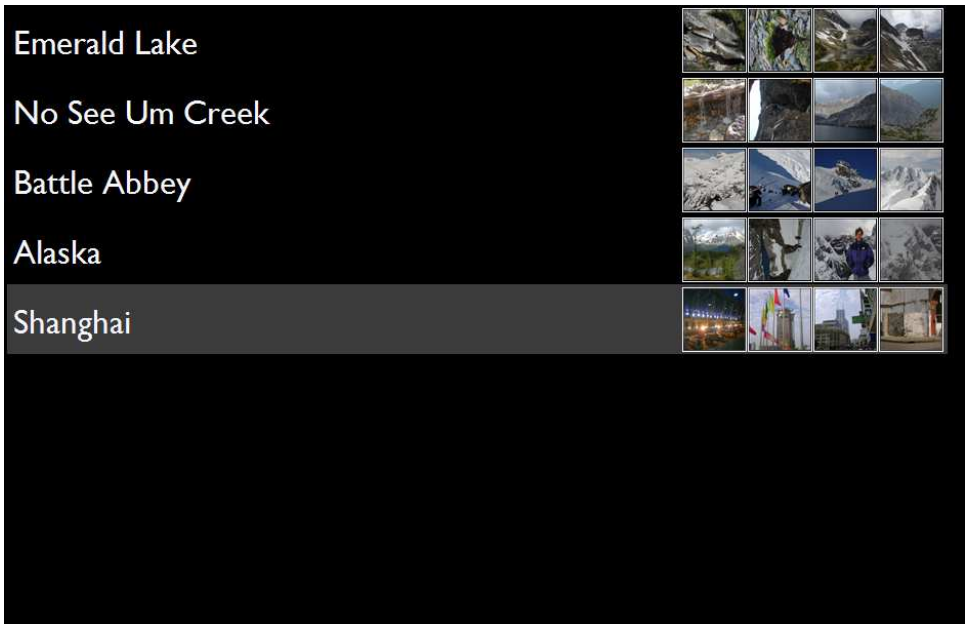


Figure 8.3: Browsing collections in the slideshow view

can scroll through the list and invoke a slideshow of any photo set using the circular touch scroll device, or the mouse. As we will see, linking these sets to mementos is optional rather than mandatory.

8.2.3 Linking to Other Items

Our next revision to SOUVENIRS revisited how people create and use custom physical items links. In the system demonstration portion of the study, participants noted concerns about the scalability of the system. If physical links were desired for every photo set, the number of displayed mementos to be kept would cause problems of clutter. As such, many participants suggested the option to use index cards or single photographs - as many of these items can be easily and neatly kept together for use with the system. Alternative items are also useful for photo sets that might not have an appropriate memento for linking.

We provide two options to create such custom items. First, we now provide credit card-sized RFID index cards (Figure 8.4, left); these cards are recognized as tags by the system,

Figure 8.4: Index cards and prints can easily be created to use as custom links with SOUVENIRS.

but allow the user to annotate the cards with written descriptions. The second is to provide the ability to easily print exemplar photos through the system. To do this, SOUVENIRS now includes a dedicated photo printer connected to the large display (Figure 8.4, right), and a print button in the slideshow interface for one-click printing. While browsing a photo set, the currently displayed photo can easily be printed via the on-screen button. Thus, the user can quickly print a representative photo for the set, and turn it into a link by attaching a thin sticky-backed RFID tag to the back of the print. Both the index card and representative print allow people to easily store many links near the display, such as in an index or photo box, avoiding clutter issues with other mementos.

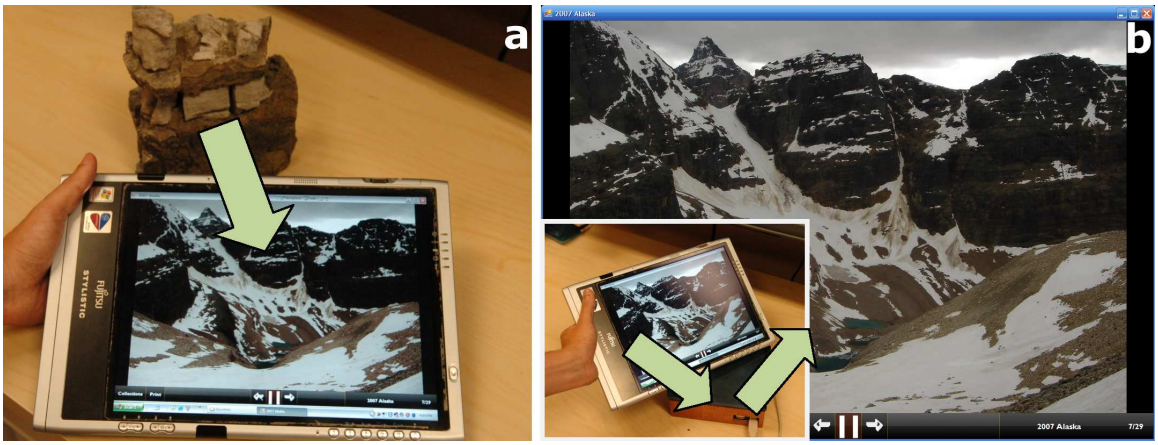


Figure 8.5: Mobile displays used to discover links in place.

8.2.4 Mobile Devices

Our final revision concerns using mobile devices in order to discover associations in place. Through our study we saw that displayed mementos, such as *collectibles*, could be located throughout the home. As well, some mementos are not transportable. i.e., because of weight, fragility, or because they are anchored (e.g., wall hanging). As such it would be cumbersome and undesirable to have to move these items to the display to invoke a slideshow. To address this we use mobile devices, such as a tablet PC or PDA. These can easily be moved about the home as a way to retrieve linked photos without moving the memento.

We added a mobile device, in our case a tablet PC, with a Phidget RFID reader fixed to its back via velcro strips. The tablet is connected to the home network via wireless, and is able to access the photos shared with SOUVENIRS. With this setup, a photo slideshow can be viewed on the tablet display simply by bringing it close to any tagged memento. This is demonstrated in Figure 8.5a, where a person has brought the tablet up to a tagged rock. The tag is sensed by the tablet, and a slideshow of the associated photos is displayed.

This set up allows links to photos to be discovered without the need to move the displayed memento. This is not perfect as the smaller display size and viewing angle restrictions make the mobile display less desirable for groups viewing photos. Where the tablet can be passed

around between people (much like a photo album), we still believe that guests would be more comfortable sharing photos over a large display in the living room. To address this, the mobile display itself is used as a physical link to the photo set it currently displays. An RFID card is also fixed to the back of the mobile device, allowing it to be detected by the sensor bases. The mobile device is aware of its tag identifier, and is able to temporarily associate that tag with the photo set it is currently displaying. Using a *pick and drop* style technique [Rekimoto, 1997], a person can use the mobile display to pick the photos from a displayed memento (Figure 8.5a), and drop the photos on to the large display by placing the tablet over the sensor base, triggering the same slideshow (Figure 8.5b).

8.2.5 Implementation

In the previous sections I have described features for the revised SOUVENIRS that are motivated by our results. This section will present the technical details behind the underlying changes in our revised prototype implementation that allow these features.

Network Shared

The key underlying change to the original prototype is that the system must now share photo sets over a home network in order to allow use with multiple displays (i.e. desktop computers, mobile devices, and the large display). Our prototype now uses a network shared folder as the central server for photos shared using the system. The system assumes this shared folder, which can be set up on a PC running Windows, is accessible to all computers running SOUVENIRS. The shared folder stores a library of all the photos and meta-data used by the system.

The remaining computers running SOUVENIRS will access this folder as clients. When the SOUVENIRS software is started, the configuration dialog (Figure 8.6) is shown. Through this dialog the user can specify the shared folder to be used, by either using the *browse* button to locate the folder, or by selecting a previously used folder by selecting it from the drop-down list in the text box (the last folder used is automatically filled in by default). Once connected,

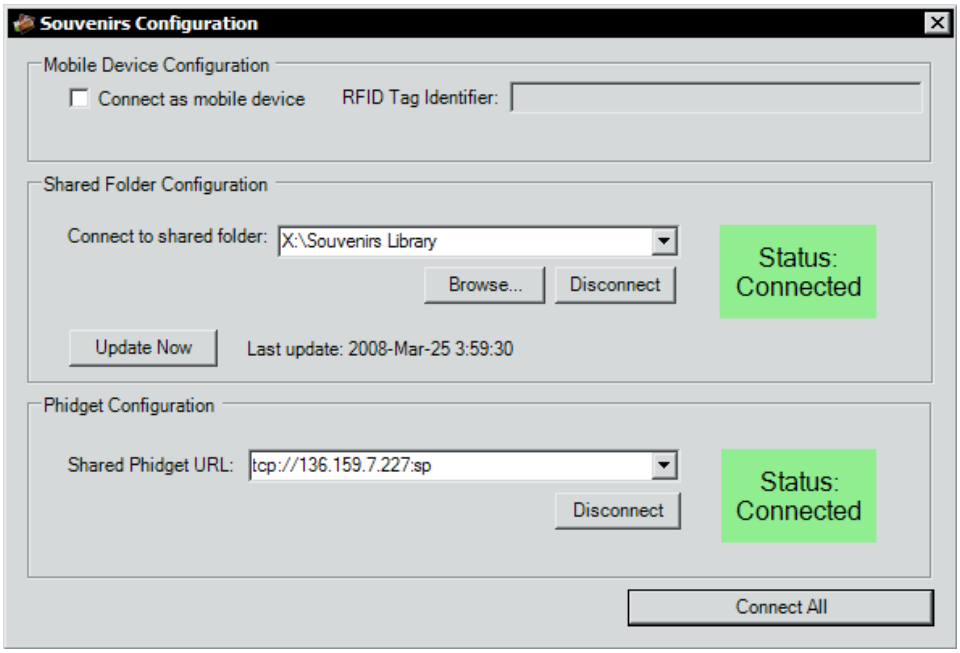


Figure 8.6: SOUVENIRS configuration dialog.

SOUVENIRS is designed to run continuously, and its views, configuration, and functionality are accessible via an icon located in the system tray (shown in Figure 8.1b).

The running SOUVENIRS clients manage the library of photos in the shared folder, which is not intended to be modified by users directly. When a set is added using the *photo management view* (Figure 8.1), a folder for the set is created in the shared folder, and the photos in the set are copied to that folder. Figure 8.7 gives an example showing how the system structures the files in the shared folder. Figure 8.7a is the top level of the library, containing folders for each shared photo set (as well as data files used by mobile displays, described later). Figure 8.7b is the contents of a folder for a particular photo set, containing the copied files for each photo in the set. Additionally, the folder contains two subdirectories: "`key`", and "`thumbnails`", which contain images pre-computed by the system for speed reasons. The first, "`key`", contains the four thumbnail preview as used in the collection view (Figure 8.3). The second, "`thumbnails`", contains thumbnail versions of each image in the set, which are used in the *photo management* view. These thumbnails are computed when a photo set is first added to the

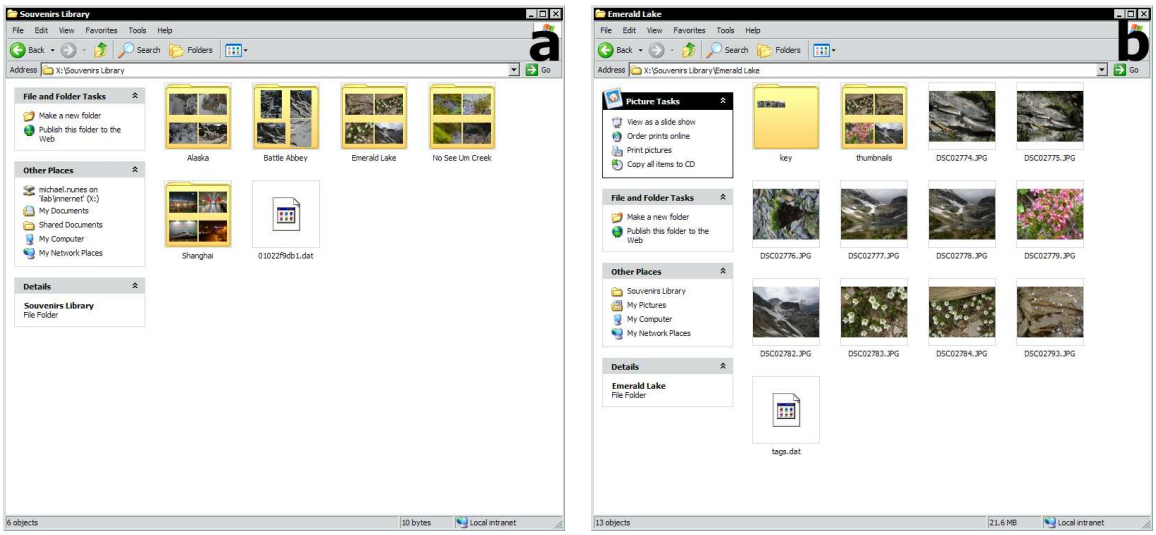


Figure 8.7: Structure of the SOUVENIRS shared folder library.

system, and are stored to avoid time delays in loading full-resolution images when using these views. Finally, the folder contains a data file, "`tags.dat`", which stores a list of the RFID tag identifiers associated with this set.

Avoiding Time Delays

With the photos and meta-data for sets in the library kept in the shared folder, any instance of SOUVENIRS connecting to the shared folder has access to the necessary information. While photos to be displayed by the system could be accessed directly from the shared folder, we found the delay in retrieving full-resolution photos over the network reduced the responsiveness of the system when showing photos. To avoid time delays, each instance of SOUVENIRS keeps a local cache, which is a replica of the library in the shared folder. An update synchronization between the local cache and shared library is performed when the SOUVENIRS software is started up and connected to the shared folder. In order to maintain synchronization, the running instance monitors the shared folder for changes. When changes to the file system occur (such as when a photo set is added), events are raised by the monitor. Each instance keeps a five second timer, which is reset when each event is raised by the monitor. When the timer elapses

an update synchronization is triggered to accommodate for the changes. The timer is used to prevent multiple updates when changes occur in rapid succession (such as when a set of photos is copied to the library); the update is performed after the changes are made. Because the local cache is kept in sync the instances of SOUVENIRS retrieve photos from it, rather than the slower shared folder.

Another method to reduce time delays is employed in the slideshow view. Loading full-resolution photos, even from the local cache, can still introduce a lag in responsiveness when scrolling through a set. We improve responsiveness lost by asynchronously loading both the pre-computed thumbnail and full-resolution photo. Due to its smaller size, the low quality thumbnail loads quickly and is displayed, providing a quick response. When the full-resolution photo finally loads, it is swapped and displayed. If the user is scrolling quickly, they may continue scrolling past before the full image loads. If this occurs, the in-progress load is stopped before the next photo is loaded. The result is that the user can scroll quickly, using the thumbnails to find the photo they want, without delays as full images are loaded.

Mobile Devices

Additional information is required for the system to use mobile devices as described previously. An instance of SOUVENIRS running on a mobile device must know the identifier for its RFID card in order to associate itself with the photo set it displays. This is done in the configuration dialog by checking the mobile device check box and entering the identifier in the text box, as shown in Figure 8.8. When the mobile device connects it creates a data file named after its identifier in the shared library (an example is seen in Figure 8.7a). The data file simply contains the name of the photo set the mobile device is displaying, or is empty if no set is displayed. When an instance of SOUVENIRS detects an RFID tag, it checks both the tag data files for each photo set, as well as the mobile device data file names for a matching identifier. If the tag represents a mobile device, its data file is read and the associated set, if any, is loaded.

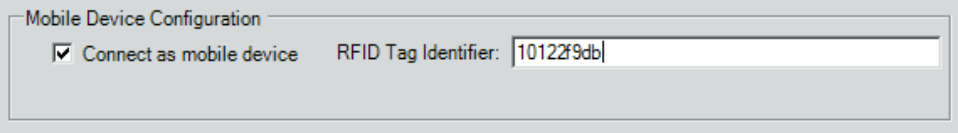


Figure 8.8: Mobile device configuration

8.3 Summary

The design rationale and original prototype implementation of SOUVENIRS, which was based on ideas from the fields of ubiquitous, tangible, and domestic computing, was presented in Chapter 3. To build on this, we sought to study specifically how a system for sharing digital photos based on links to physical mementos might be adopted in the domestic environment. Our goal was to build an understanding to verify our design rationale, and suggest ways in which the original prototype might be revised to better fit current domestic practices. This chapter demonstrates that our study goals have been accomplished, by looking back at our original design rationale, and reflecting on how the results relate to it. Additionally, I have described the motivation and implementation of a revised prototype of SOUVENIRS based on ideas from the results.

Chapter 9

Conclusion

In this chapter I conclude the work presented in this thesis. I begin by re-stating the problems I set out in Chapter 1, and summarize the research contributions I have made in addressing those problems. I then discuss some potential directions for future work to build on this research. Finally, I end with some closing remarks.

9.1 Thesis Problems

In Chapter 1 I defined two problems for designing a system to encourage photo sharing in the home through links to physical memorabilia.

Problem 1: *We do not have a sufficient understanding of current domestic practices with print photos, with digital photos, and with souvenirs, to validate and critique our design idea.* We do not know how the various affordances - of the domestic setting, of print photos, and of digital photos - currently influence photo sharing. Research in domestic computing suggests *physical location* of such artifacts is crucial to consumption of communication information. We speculate this creates opportunities for photo sharing, but are unclear on if or how it applies. We also speculate that physical memorabilia can link to digital photos as memory evoking objects, but do not know if and how they could be situated and shared in the home such that they could encourage opportunities for photo sharing.

Problem 2: *We do not know how a system for photo sharing that links physical memorabilia to digital photo sets can be designed to fit in with domestic practices.* Such a system will rely on its fit to routines for its adoption and success. It is unclear how and what souvenirs and mementos are kept such that they would be amenable for use with the system. The system must also accommodate for the ways families typically store and share their photos in the home. By

situating the system within these practices, we improve its potential utility.

9.2 Contributions

In this thesis I have addressed these problems through two main research contributions.

Contribution 1: *An understanding of current domestic practices with print photos, with digital photos, and with souvenirs, which is relevant to our design idea.* In Chapters 5 through 7, I presented the results of a contextual study of family homes, which forms an understanding of these practices.

First, I presented a comparison of how print and digital photos are organized and located in the home, and how this affects their accessibility for sharing. We saw that organization strategies between print and digital photos were similar: usually one family member acted as a primary organizer, and photos were typically arranged by date or event. However, the physical location of print photos made them more accessible for sharing in the home. This included easy access through physical proximity to where guests were typically entertained. Additionally, print albums were typically kept in an area that all family members routinely use - opportunities for sharing are increased when anyone in the family knows about, and can access the family photo collection.

Next, I related how and why photos were shared by families, and how current affordances of print and digital photos support these practices. In particular, we saw a desire to use digital photos for socially-motivated face to face photo showing in the home. But, when a print set existed they were preferred for showing. Other researchers have argued that prints are most amenable for face to face showing [Crabtree et al., 2004, Frohlich et al., 2002], and considered how digital technologies could provide better affordances when showing photos [Lindley and Monk, 2006]. Our work overlaps with, and validates some of their findings, and extends upon them by considering how barriers that discourage digital photo sharing can be overcome.

Next, I presented a categorization of physical souvenirs that takes into account how they are typically situated and used in the home. This revealed four classes of souvenirs with different potentials for use as links to digital photos. Other researchers have considered how souvenirs are suitable as links to photos for memory recollection [van den Hoven and Eggen, 2005]. Our work extends this by considering how these items are situated in the home such that they can encourage digital photo sharing.

Finally, I presented families' reactions to the use of a system linking digital photos to physical mementos. This included a discussion of issues that challenge how such a system might fit in with families routines.

With this understanding, we were able to validate our design rationale with real home practices, and critique our initial system design *(Problem 1)*. More generally, this understanding contributes to the body of insights into the domestic environment that is needed by domestic computing researchers and designers.

Contribution 2: *A prototype implementation of a system linking digital photos to physical memorabilia, a re-evaluation and requirements analysis for improvements to that system based on real domestic practices, and a revised prototype that provides a better fit to those practices.* In Chapter 4 I presented the design rationale and prototype implementation of SOUVENIRS - a system that uses physical memorabilia to trigger slide shows of digital photos. This design was motivated by prior literature in tangible, ubiquitous, and domestic computing. SOUVENIRS design premise was to encourage photo sharing in the home by: providing opportunities for sharing through tangible mementos, overcoming access barriers and technological delays, and situating photo sharing within the social setting of the home.

In Chapter 8, I critiqued and revised the SOUVENIRS design using the understanding of domestic practices and of families' reactions to the system gained through the study. First, I considered how families could make subsets of their digital photo collections available for sharing with the system. I then considered how the system could provide a better fit with

various practices around displayed souvenirs. In particular, I made souvenir linking optional for homes where souvenirs were rarely displayed, or where large collections of digital photos would encourage an undesirable excess of souvenirs to be displayed. Then I considered how easily stored custom items could be created with a photo printer or writeable tags, and used as physical handles for many photo sets, or for photo sets that have no appropriate memento for linking. Finally, I considered how mobile devices could be used to discover links when moving displayed souvenirs was undesirable.

I then built a revised prototype implementation of SOUVENIRS that incorporates the ideas from this critique in order to provide a better fit to observed domestic practices *(Problem 2)*. While this system was not formally evaluated, it stands as an embodiment of our design ideas and approach.

9.3 Future Work

We have now seen how affordances of print and digital photos affect potential for photo sharing in the home. Indeed, the physical location of print albums creates opportunities for photo sharing - by being readily available to show guests, and being accessible to all family members. We have also considered how a system may bring back some of these affordances by giving digital photo sets a physical embodiment in the home through displayed memorabilia, and considered how such a system can fit in with domestic routines.

Future work in this area should consider long-term trials of in-home system use. We used a video demonstration to gather initial reactions on how families might consider using our system, but further insight could be gained from installing the system as a true technology probe [Hutchinson et al., 2003]. Observing how families adapt to such an installation over time may enrich our understanding of photo sharing and souvenir use in the home, and reveal families' desires for digital photo sharing systems. These observations could fuel further technology designs for digital photo sharing in the home.

Of course, the goal of long-term trials is not simply to guage the usability and adoption of our implementation, but to observe how the introduction of a SOUVENIRS style system will change a family's cultural and social practices over time. For instance, the system could create an increased desire to collect souvenirs specifically for use as links to photos. As well, a family's practices with displaying souvenirs could change with the benefit of keeping them near the TV for use. Similarly, a family might put greater consideration into how their homes are arranged to naturally allow storytelling through displayed souvenirs and photos. Family practices are not static; we expect they will change (hopefully positively) to create meaning around the technical and social artifacts we introduce.

Future work should also consider the applicability of this work to other forms of digital media in the home, and also to domains outside the home. As computing technologies are become increasingly pervasive in the home, more of the artifacts dealt with in everyday family life are becoming digital, and these artifacts may be desirable for sharing in the home. An obvious example closely related to our work would be home movies. But it may be worthwhile to consider what other forms of media, e.g. family documents, could be embodied and shared through links to physical objects. Similarly, future work could look beyond the home, and consider how physical objects could be used as links to digital photos in other domains, e.g. museum exhibits, or augmenting books or magazines.

Finally, another direction for future work is to consider alternative interfaces for displaying linked photos. Our system provides a simple slide show, which leverages on existing affordances of the typical living room, i.e. appropriate furnishings for guests, and large screen TV display. However, alternative interfaces, such as a tabletop display [Carpendale et al., 2006, Shen et al., 2002], could afford greater involvement for viewers and potentially increase enjoyment of the photo sharing experience. Extending beyond photo showing, future work could also consider using souvenirs in technologies for digital photo display [Kim and Zimmerman, 2006, Swan and Taylor, 2008]. Framed prints and physical mementos are often intermingled within

domestic displays - placing a digital photo frame amongst souvenirs linked to photos could provide a means to select photos for display.

9.4 Encouraging Creative Practices

In the previous section I noted that long-term in-home trials could reveal how families might develop new practices given the availability of a system such as SOUVENIRS. However, the interviews and our own experiences with the implementation allow us to speculate on how new practices might evolve, particularly in encouraging creative use of tagged objects.

For example, trip output items (e.g. guidebooks, maps, etc.) present potential for creative re-purposing as links to photos. Currently, these items are typically stored away as they have no practical purpose after the trip. Yet, they are strongly linked to memories, and often have related photo sets. Indeed, some families liked keeping these items with their associated prints, either simply as a way to store them, or as a more creative effort such as a scrapbook. Several families suggested creative uses of these items as tagged objects. Examples include using four tags in each corner of a guidebook to show four different time periods of a trip, or tagging various locations on a map to show photos from those locations.

Further creative ideas can build on creating custom objects as links. For example, representative photos printed through the system could contain a barcode allowing them to be immediately used as links. These photos could then be used in an album or scrapbook containing items that act as indices to various digital photo sets. Another possibility is creating custom objects to represent photos from a certain time period, such as by year, or perhaps using diary pages as links to photos from around that time.

While these ideas may be speculative, they illustrate the creative potential in providing the affordance to link physical objects to digital photos, which goes beyond our original intent of simply linking physical souvenirs to their associated photo sets.

9.5 Closing Remarks

In this thesis I have presented the design of SOUVENIRS, a system for encouraging digital photo sharing in the home through physical memorabilia, and an investigation of families' current practices with print photos, digital photos, and souvenirs. Of course, the true utility of such a system is best guaged with an actual deployment. Yet, our research illustrates some of the issues with digital photo technology in the home, and begins to consider how we might address those issues with solutions that move digital information "off the desktop" where it can be situated in the domestic environment. As digital photography has become prevalent in the home, there is a very real need to consider and address issues that affect how families use their digital photo collections.

This work also contributes to the broader question of how technologies can be designed that allow families to share digital artifacts in the home. This question becomes increasingly important as new computing technologies are adapted by families. By investigating a specific domain, i.e. photo sharing, the findings of this work contribute to the larger body of insights that are needed to sensitise designers to the nature of the domestic environment.

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Appendix A

Study Documentation

This appendix provides documentation relevant to the study *Sharing Photographs and Souvenirs in the Home*, conducted by Michael Nunes and Carman Neustaedter in the winter/spring of 2007. The contents are as follows:

1. **Study Recruitment** is a notice given to potential participants to give them information about the study.

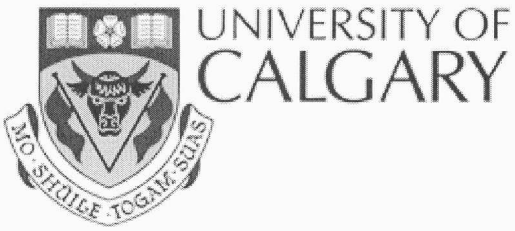
2. **Consent Form** given to, read, and signed by all study participants.

3. **Study Description** is a script used at the beginning of the interview, and throughout to introduce new stages.

4. **Study Codes** gives a listing of the codes generated from the open coding portion of the analysis.

Appendix B contains a scan of the signed **Ethics Approval** for the study. Details of the study methodology are given in Chapter 4.

A.1 Study Recruitment



Sharing Photographs and Souvenirs in the Home

Study Recruitment

Investigators: Saul Greenberg, Michael Nunes, and Carman Neustaedter, Department of Computer Science

Experiment Purpose: The first purpose of this research is to understand how people use, store, and share paper and digital photographs, souvenirs and mementos with others. The second purpose is to see how people react to a technology that supports how souvenirs are linked to digital photos.

Procedure: In this study, you will be asked interview questions about the existing photo and souvenir collections in your home, and how you share them with others. As well, we will ask for your reaction to a technology design idea based around your souvenirs and photos.

Requirements: We ask that you belong to a household with at least one other person, and that the entire household be present at the interview if possible. At least one person in your household regularly takes digital photos and stores them in the home.

Commitment: Your participation will take one to two hours and you will be compensated for your time with a payment equivalent to approximately $50 per family.

To Participate or For More Information:
Send email to: nunes@cpsc.ucalgary.ca or carman@cpsc.ucalgary.ca

A.2 Consent Form

UNIVERSITY OF CALGARY

Saul Greenberg
Department of Computer Science
University of Calgary
2500 University Drive
Calgary, AB, CANADA T2N 1N4

CONSENT FORM

Research Project Title: Sharing Photographs and Souvenirs in the Home

Investigators: Saul Greenberg, Michael Nunes, and Carman Neustaedter

This consent form, a copy of which has been given to you, is only part of the process of informed consent. It should give you the basic idea of what the research is about and what your participation will involve. If you would like more detail about something mentioned here, or information not included here, you should feel free to ask. Please take the time to read this carefully and to understand any accompanying information.

Purpose: The purpose of this research is to understand how people use, store, and share paper and digital photographs, souvenirs and mementos with others. The second purpose is to get people's reaction to a technology that supports how souvenirs are linked to digital photos.

Participant Recruitment and Selection:
To be a recruited for this study, we ask that you allow us to use and analyze your results from the study.

Procedure:
The study should need about one to two hours of your time. You will be asked interview questions about the photo and souvenir collections in your home, and how you share them with others. During this time, you will be asked to show us your existing collections.

Confidentiality:
Your anonymity will be strictly maintained. Reports and presentations will refer only to a participant identification number and will be in a secure filing cabinet or on a secure computer. Unless you give us permission to do so, confidential information will be hidden from photos and videos prior to the publication of results from this study.

Risks:
There are no known risks, however, if you feel uncomfortable you are free to quit at any time, although all information collected from you up to that point may still be used in our study analysis.

Investigators:
Saul Greenberg is a Professor, while Michael Nunes is an MSc student, and Carman Neustaedter is a researcher (formerly a PhD student), all are in the Department of Computer Science at the University of Calgary.

Your signature on this form indicates that you have understood to your satisfaction the information regarding participation in the research project and agree to participate as a subject. In no way does this waive your legal rights nor release the investigators, sponsors, or involved institutions from their legal and professional responsibilities. You are free to withdraw from the study at any time. Your continued participation should be as informed as your initial consent, so you should feel free to ask for clarification or new information throughout your participation. If you have further questions concerning matters related to this research, please contact:

Dr. Saul Greenberg (saul@cpsc.ucalgary.ca) or Michael Nunes (nunes@cpsc.ucalgary.ca)

The University of Calgary Conjoint Faculties Research Ethics Board has approved this research study. If you have any questions or issues concerning this project that are not related to the specifics of the research, you may also contact the Research Services Office at 220-3782 and ask for Bonnie Scherrer.

UNIVERSITY OF CALGARY

Saul Greenberg
Department of Computer Science
University of Calgary
2500 University Drive
Calgary, AB, CANADA T2N 1N4

Participant's Name	Date
Participant's Signature or Signature of Parent/Guardian	Date
Investigator's/Witness's Signature	Date

A copy of this consent form has been given to you to keep for your records and reference.

A.3 Study Description

The following description should be read to each participant at the beginning of the study to inform participants of the procedures prior to giving consent. Italicized text are instructions to the investigator.

Introduce yourself.

- My name is (your name), and I will be giving you instructions on what to do and will answer your questions.
- We're researching the use of photographs and souvenirs, and how they are displayed and shared amongst families and close friends in the home. We would like to understand the practices for storing and showing photographs and souvenirs.

Tell them about the experiment.

- The study will involve an in-depth interview about the processes you use to sort and store photographs and souvenirs, as well as the ways in which you display and share these items with your family and friends within the home. We will be asking you to show us samples of your current photos and souvenirs, and how you use them. Throughout the study we will be taking notes and would like to take photographs of photograph and souvenir displays in your home, given your permission.

Tell the participant that it's OK to quit at any time.

- If you feel uncomfortable, you are free to quit at any time. Do you have any questions at this point?

Give them the consent form to sign. If it is not signed, do not proceed.

Proceed with the interview. Have it centered around their current paper and digital photo collections and how they share it, i.e., they should bring out their photos and talk about them.

- Please show me the areas in your home where souvenirs and photographs are displayed and shared, as well as where and how these items are stored when not out in the open. This could include photo albums, storage boxes, mantles or display areas, as well as computers or digital cameras in the case of digital photographs. As you do this, lets talk about how you currently share them with each other and visitors to your home.

- Tell us about the last time you shared your photos/souvenirs with someone.

Next, tell them about the system, show them a prototype of it, and get their reaction to it.

- Our current idea is that families can attach tags to physical souvenirs and mementos, and in turn link these physical items to associated information, such as collections of digital photographs. This can provide people with a means to store and retrieve digital photographs via links with their representative souvenirs, and construct interactive displays allowing digital photographs to be shared with close friends and family members. For example, souvenirs brought close to a Television plasma display would automatically display associated image collections. We would like your reaction to this idea, i.e., what you think of it, whether you would use it, how you foresee using, and what we could do differently.

Appendix B

Study Codes

B.1 Stage 1: Print and Digital Photos

B.1.1 Photo Types

[Day-to-day] Around the home, candid, day-to-day pictures.

[Trips] Vacations or other events that involve going places.

[Special Events] Parties, ceremonies, performances, etc.

[School Photos] Professional photos of children taken at school.

[Back Home] Seen when families have moved from another country, pictures from the home country.

[Copies] Double prints.

[Relevant] Photos which are somehow relevant or interesting to the person or people that they are being shared with (e.g. shared experience, common interest).

[Friends] Photos of friends.

[Child] Pictures of the children (particularly young).

[Recent Photos] Photos taken recently.

[From Friends] Photos recieved from friends.

[From Family] Photos recieved from family members

[Scanned photos] Photos scanned from prints.

[Liked Photos] Photos that are particularly liked or favorites.

[Scenery] Photos of nature, etc.

[Candids] Not posed, informal.

[Parties] Pictures taken at parties.

[Dinners] Pictures taken at dinners.

[Teams] Photos from team events, such as a basketball team.

[Sports] Photos from sport event.

[School] Photos taken (informally) at school.

[Places to go] Photos from a place that a friend may not have been to and might want to see or go to.

[Video] Videos.

[In Common] Photos of things that you have in common with the person you are sharing them with.

[Portrait] Picture of one person, typically a professional shot.

[B&W] Black and white

[Panoramic] Extended (wide) panoramic photos.

[Wedding] Wedding photos.

[Everything] Takes pictures of ”everything”.

[Group Events] Events involving a particular group, e.g. sports team.

[Awards] Recieving awards at ceremonies.

[House] Pictures of the house.

[Architecture] Buidings.

[Asth Pleasing] Asthetically pleasing photos.

[Personal] Personal photos (not formal, like family photos).

[Old Pictures] Older pictures, i.e. taken by parents.

[In Conversation] Pictures that come up in conversation or are asked to be seen.

B.1.2 Storage Locations

[Office] A home office.

[Bedroom] A family members’ bedroom.

[Hallway] A hallway in the home.

[Livingroom] The family living area.

[Diningroom] The family dining area.

[Basement] The basement of the home (often as out-of-the-way storage).

[Shelf] Placed on a shelf.

[Wall] Mounted on a wall.

[Cabinet] Kept in a cabinet.

[Drawers] Kept in a drawer.

[Closet] Kept in a closet.

[Parent House] Items stored in a parent’s house (typically as younger couples, recently moved from parents).

[Fridge] Mounted on the fridge.

[Fire Safe] Kept in a fire-proof safe.

[Guest Bedroom] Kept in a guest/spare bedroom.

[Corner] Stored in a corner of a room.

[Staircase] A staircase in the home.

B.1.3 Storage Types and Strategies

[Albums] Albums.

[Multiphoto Frames] Frames with multiple photos displayed.

[Frames] Picture frames.

[Loose] Loose photos.

[Chronological] Stored in order by date taken.

[Event] Stored by event.

[Location] Stored by the location the photo was taken in.

[People] Stored by the people in the photo.

[Fit In] Stored where ever they “fit in”.

[Don’t put wall holes] Don’t make new holes in walls (for hanging photos).

[Date] Stored by date taken.

[Envelopes] Photos stored in envelopes.

[CD] Stored on writable CD disc.

[DVD] Stored on writable DVD disc.

[Camera] Photos still stored on camera.

[OL Site] An online website for sharing photos (3rd party website).

[OL Personal] Online personal website for sharing photos.

[OL Folders] Folders/directories online.

[OL Photo Gallery] Photo gallery website.

[Computer] Stored on a personal (desktop) computer.

[Laptop] Stored on a laptop.

[Work Computer] Stored on a computer at work.

[Blog] Displayed on a blog.

[Box] Stored in a box.

[Available Space] A location is chosen because it provides adequate space to store the items.

[Seperate] Photos owned by different individuals are stored seperatley (seperate computers for example).

[Cross Labeled] Printed digital photos given labels allowing the corresponding original digital photo to be found.

[Brought Out] Some photos were brought out too look at and remained somewhere other than where they’d normally be kept.

[Shared HD] Stored on a shared hard drive.

[Unsorted] Stored in an unsorted fashion.

[Pragmatic] Pragmatic reasons for putting something there, ex. because it’s a shelf, or photos hung where there are studs in the wall.

[Time to Albumify] Stored in a location until there is enough free time to put them into albums.

[Near Guests] Stored in a place near where guests would be.

[Different OS] Different os’s are used, photos wind up in different places as a result.

[iPod] Stored on an ipod.

[Slides] Stored as slide albums.

[Used Area] Is a most used area, near where people often are.

[Home Server] A home server set up for secure storage of photos.

[Mark for Print] Photos labeled or marked for printing.

[Numbered] Stored by numbered filename.

B.1.4 Shared With

[Friends] Friends.

[Family] Other family members.

[Special Interest] Includes special interest groups with whom you might wish to share related photos with, for example a sports team.

[Others In Photo] Other people (family or friends) who are in the photo.

[Students] Students (i.e., when a teacher).

[Interested] Others who are interested in seeing them.

[Random Internet] Random people on the internet.

B.1.5 Likes, Challenges, or Dislikes

[Organized] Keeps photos organized.

[Prevent Loss] Helps to prevent loss.

[Prevent Damage] Helps to prevent damage.

[Easy to Find] Photos are easy to find.

[Hard to Find] Photos are difficult to find.

[Relaxing] Looking at the photos (in a particular form) is relaxing.

[Disorganized] Photos disorganized, perhaps because they were not organized in the first place, but might also get disorganized as they are taken out or looked through.

[Unreliable] Loss of access due to some system failure, for example online site is down or computer crash.

[OL Sharing] Sharing of photos online.

[Not Many Viewable] Refers to the number of people that can view the photos at once, difficult to show to a large number of people.

[Many Viewable] Can be viewed by several people (such as on a TV).

[Hard to Organize] It is hard to organize the photos.

[Lots of duplicates] Lots of duplicates are accumulated.

[Can’t Move] When moving, it is difficult or impossible to bring collections.

[Hard to Remember] Hard to remember what a photo is of/when a photo was taken, hard to remember what is in albums - what photos are around.

[Fun to Search] Searching through photos is enjoyable, get to look at the others you might not have been looking for.

[Easy Access] Easy to get at the photos.

[Degrade] Photos degrade over time.

[Nice to look at] Photos (in a particular form) are ’nice’ to look at.

[Not nice to look at] Photos (in a particular form) are ’not nice’ to look at.

[Hard to caption] Hard to write captions/labels.

[Avoids Clutter] Storage mechanism avoids clutter.

[Clutter] Storage mechanism causes clutter.

[Break Down] Photos/albums break down with age.

[Store Mementos] Albums can also be used to store little momentos along with the relevant pictures.

[Loss] The things can get lost and hard to find again.

[Can't Transport] It is difficult to take with you somewhere else to show them.

[Can Transport] You can take them with you to show to someone else.

[Zoom] Zoom feature on camera.

[More Pictures] Can take more pictures (with digital cameras).

[Delete] Pictures can be deleted (digital photos).

[Media Fails] Media (such as a cd) may fail.

[Leave Comments] Others can leave comments (such as on a blog or photo sharing website).

[Edit Features] Features for self-editing digital photos.

[Can't Edit] No features for self-editing print photos.

[Naming] Naming photos (digital).

[Scanning] Scanning print photos to digital.

[Need Film] Need to keep a supply of film in order to be useful.

[Developing] Need to take film photos to get developed.

[Time to Organize] Needs alot of time to go through and organize, such as to put together an album.

[Captions] Captions can be used to remember details.

[Hard to Send] Hard to send to others.

[Making Copies] Making duplicates.

[Date Reference] Dates on pictures can be used to reference.

[Surf Through] Surfing through various photos on the computer.

[No Film] Don't need to worry about carrying or buying film.

[Backup] Create backups of photos.

[Centrally Stored] Everything stored in one central place.

[Send Link] Sending a link, rather than an email attachment.

[Large Files] Files too large to send.

[Print Good] Can print just the good pictures.

[Hard to Show] Hard to show to other people.

[Making CD] Making cd's for people.

[Battery Life] How long the batteries will last.

[More Social] The activity of looking through them is social.

[Auto Organized] Automatically organized.

[Printing] Printing, (takes time, expensive, printers difficult).

[Albums for Event] Albums which contain an entire singular event.

[Seperate Repository] Repositories of photos kept on computer is only accessable to the owner of that computer/account.

[See Output] You can see the output on a digital camera right away.

[Archival] Will the format be archival? will the photos still be viewable in 50 years.

[Show Older] Nicer to show to older generations who maybe don't like the "technology".

[Sign Up] Others have to sign up to some service to see photos.

[Slow Connection] People with slow internet connections will have trouble sharing photos.

[No Connection] People who are not online will not be able to see the photos.

[Easy to Share] Easy to share with others.

[Mailing] Have to prepare and mail to others.

[Quick] Can get a photo quickly when you need to.

[Screen Viewing] Viewing on screen difficulties, angle, brightness, etc..

[See Technology] You can see the technology when viewing digital photos.

[Hides Technology] The technology behind print photos is 'hidden' when viewing print photos.

[Panoramic Fit] The odd size of the panoramic prints can be difficult to fit in normal albums with the rest of the photos.

[Selective Print] You can select to print only good ones, avoid the expense of developing ones that didn't turn out.

[Developing Cost] Cost to get photos developed.

[Show Bad] Inability to select only the good pictures when showing, need to show the bad to (ex. camera on tv sharing).

[Share on Own Time] Can be shared with others on their own time - like with an online album, they can look at them when they want.

[Date on Picture] The date is placed on the picture.

[Update Webpage] Updating an online page is tedious.

[Expensive] Cost (i.e. film, prints, etc.) is high.

[Update Displays] Effort to update photos displayed.

[Low Quality] Quality (e.g. screen resolution for viewing digital photos) is low.

[Setup OL Site] Online sites for sharing are difficult to setup.

[Convenience] Convenience of digital photos, faster to get and see.

[Software Arrange] Software re-arranges where the files and things are.

[No Hard Copy] Is worrying that there is no hard copy.

[DVD With Video] Can make DVD's to send with pictures and video clips.

[Ink Use] Printing at home uses too much ink, printer runs dry.

[Long Term] Photos will be stored in hopes that they will be available in the long term.

[Send Folders] Folders make it difficult to send, have to go through and select only a few.

[Find Space] Finding space (to store prints) is difficult.

[Loading Time] Time takes to load up digital pictures.

[Take Video] Digital cameras can also take videos.

[DVD Backup] DVD backup not feasable as there would be too many and too hard to access.

[Access Anywhere] Online albums allow you to access photos from anywhere there is a computer.

[Edit] Can edit photos/photoshop etc.

[Distance Sharing] Share photos at a distance.

[Computer Illiterate] Hard to share with those who are computer illiterate, eg parents rather a photo album than online album.

[Computer Time] Too much time spent on the computer.

[Surprise] Element of surprise in getting film pictures developed.

[Fewer to Manage] Fewer print photos makes it simpler to manage.

[Too many to Manage] More digital photos (multiple same shots, etc) becomes too difficult to manage.

[Have the Prints] Like having the prints, will always be viewable.

[Recent Accessable] More recent photos are stored in a more accessable place, more likely to be shown.

[Tangible] Tangible qualities (i.e., can hold, pass around, etc.).

[Cumbersome] Hard to handle, too many, heavy.

B.1.6 Finding Strategies

[Guess] Would have to guess where a picture would be.

[Album Label] Might be able to find in labeled album.

[CD Label] Might be able to find by labeled CD's

[Journal] A journal is kept which might help in finding a photo, (for example figuring out what date a particular event occured on).

[Flip Through] Would have to flip through photos.

[Thumbnails] Look at thumbnails in folder.

[Know Where To Go] Would just know where to go to find it.

[Album Style] Style of the albums are different (covers, etc), remember what it contains from appearance.

[Approximate Time] Find photos taken approximatley around that time.

[Subject] Finding depends on the subject (maybe made it .to an album or not).

B.1.7 Organizers (Household Members)

[Wife]

[All] All family members helped or know about.

[Hub]

[Teen]

[Both] Both parents

[Seperate] Seperate collections maintained by individuals

[Overlapping] Similar to seperate, but with overlapping subjects/sets.

B.2 Stage 2: Souvenirs and Mementos

B.2.1 Souvenir Types

[Gift] Items are given as gifts.

[Rocks] Physical rocks from special places.

[Trophies] Trophies or medals won for personal or team achievement.

[Dishes] Ornamental dishes, e.g., plates, vases.

[Sports] Items from sporting events, e.g., flags.

[Art] Art items like paintings or masks.

[Flags] Flag of a place visitied.

[Statues] Statues (small or large).

[Money] Coins or bills.

[Pins] Small pins with a picture or emblem printed on them.

[Lamp] A small light fixture for a desk.

[Religious] Items that have religious representation, e.g., art of Jesus.

[Stuffies] Stuffed or plush animals.

[Maps] Maps of locations.

[Pamphlet] Pamphlets describing a location, e.g., schedule, itenerary, handouts from tours.

[Useful] Items that would be considered useful, e.g., something that can be used rather than simply being on display.

[Boxes] Ornamental boxes that can be used to store items (usually small).

[Books] Non-fiction books for pleasure reading.

[Food] Food items like tea, chocolate, candies.

[Clothes] Clothing items that can be worn, e.g., hats, shirts.

[Unique] Something unique that you can’t get normally in one’s home city.

[Dolls] Ornamental dolls.

[Presents] Presents or gifts for birthdays or Christmas.

[Postcards] A pre-printed photograph from a location.

[Keychains] Rings to hold keys with special pictoral items hanging on them.

[Tickets] Ticket stubs from events.

[Flowers] Live flowers.

[Stamps] Postmarks or stamps.

[Jewellery] Jewellery items inculding bracelets, rings, necklaces, etc.

B.2.2 Locations Represented by Souvenirs

[Home] A foreign country one moved away from.

[Trips] Trips that one or more family members take.

[School] Activities occuring at school, e.g., sports games.

[Conference] Conferences or gatherings organized for a specific purpose, e.g., academic conference, band trips.

B.2.3 Reasons for Collecting/Not Collecting

[Roots] To not forget one's heritage and cultural roots.

[Pleasant] Pleasant to look at or aesthetically pleasing.

[Pride] Pride from personal accomplishments.

[Memory] To remember the event or location.

[Clutter] Souvenirs are seen as being messy and producing clutter.

[Conversation] Conversation pieces to describe a trip or place to people.

B.2.4 Storage Locations

[Bedroom] A family member's bedroom.

[Living] The family's living room.

[Kitchen] Shelves or walls of the kitchen.

[Mantle] An area used like a shelf, e.g., the top or bottom of a fireplace.

[Shelf] A shelf hanging on a wall, or case of shelves.

[Wall] Hanging on a wall directly.

[Office] In a room designated as the home office, e.g., where the computer is kept.

[Cabinet] A cabinet designed for displaying breakable items or ornaments.

[Recroom] A recreational room , usually in the basement of the home.

[Storage] A storage shelf or area in the basement of the home.

[Parents] At the home of the parents, e.g., couple may have recently moved away from their parents' home.

[Bathroom] In the bathroom on the counter or wall.

[Change] The location of items change as new ones are bought and old ones are put in storage, items are also rotated between locations.

B.2.5 Reason for Displaying/Keeping Souvenirs in a Location

[Display] An area that is easily visible publicly in the home.

[Pragmatic] An area that already has a shelf.

[Space] An area that has space to store items.

[Conv] An area that it can act as a conversation piece.

[Not Clutter] An area the won't make the items look like clutter.

B.2.6 Memoies Associated with Items

[Roots] One's heritage or cultural roots.

[Event] Memories of the event.

[People] People who gave the item to a family member.

[Location] Memories of the location the item is from.

B.2.7 Family Member Who Collect

[Wife]

[Hub]

[Teen]

[Child]

[Nobody]

B.3 Stage 3: System Demonstration

B.3.1 Activities For The System

[IHShare] Sharing with people inside the home.

[OHShare] Sharing with people outside the home.

[GiveTags] Would give tags to people as souvenir items from a trip - tag could link to online albums.

[Older] The system would work for activities done by older generation, e.g., parents or grandparents.

[Subset] Would use it for a subset of photos because the have too many to do it for all of them.

B.3.2 Activities Not For The System

[Personal] Looking at photos by oneself.

[Scrapbook] Linking photos with physical artefacts collected during trips.

[Professional] Professional viewing of photos.

[All Photos] Wouldn’t use it for all photos because they have too many.

B.3.3 Ways To Link Items

[Cards] Using cards or other items with a word or photo on it as a link to an album.

[Photo] Using a single photo to link to an album.

[Souvenirs] Using souvenir items spread throughout the house.

[List] See a list of photos or albums to view.

[Maps] Link locations on maps to photos from that area.

[DVD] Bring DVD up to TV to link to photos to give to other people.

[Multiswipe] Swipe multiple tags, one for each tagged atribute of the album, e.g., one swipe for year, one for event (e.g. 2006 Christmas).

[Many Link] Link many items to one album (in case you lost an item or forgot what was linked).

B.3.4 Likes about The System

[Find] Finding photos is easy.

[IHShare] Sharing within the home.

[Cool] A new and novel way of shiwing photos.

[Organized] It collects and displays photos in an organized fashion.

[Scroll] The scroll wheel to cycle through photos.

[Display] Running on a large display.

[Show Once] Can show a large group of people the photos once and only have to describe them one time.

[Link] Easy to link digital photos to items.

[Easy] The interaction with the photos appears easy.

[Photo] Using a single photo to link to an album.

[Speed] Photos are loaded quickly.

B.3.5 Challenges with the System

[Film] Film photos can't be seen with the system, e.g., would have to be scanned first.

[Lose] One could lose the item attached to the photos.

[Clutter] Items near the TV would create clutter and look disorganized.

[Storage] Would need a large storage area near the display.

[Find Item] Would have a hard time finding items to link, e.g., some family photos wouldn't have a representative object.

[Small] The TV they use is too small for easily viewing photos.

[No Items] They don't have physical items that could easily be associaed with the albums.

[Others] Other people wouldn't know what items were assiciated with the albums.

[Forget] One could forget what item is linked especially if there are multiple trips to the same place.

[Change] The meaning of items may change over time.

[Linking] Actually linking object to photos would not be desired.

[Break] Don't want to break items by moving them around.

[Scrapbook] Linking photos with physical artifacts collected during trips.

[Not Organized] Photos appear to be unorganized.

[Too Many] They have too many photos to link items with (tedious).

B.3.6 Changes to the System

[Touch] Don’t want to directly touch the screen for interaction (it would get dirty).

[Music] Play music in the background of a slideshow.

[Videos] Add support for showing videos.

[Remote] Would use a remote like a TV or XBOX remote instead of the wheel.

[Sync] Functionality to synchronize photos from multiple cameras/sources.

[Select] Show only photos from a particular person.

[Folders] Use folders to click on for albums rather than swiping objects.

[Tag] Tag photos by the people in them.

[Upload] Swipe an item to send an album to an online page.

[Transitions] Transitions between photos.

[Mix Photos] Show photos from different albums as one slideshow.

[Multiple] View multiple photos at once on the screen (like album pages or thumbnails, but because it is a large display the photos will be larger).

[Bring Album] Bring album near the display, and photos are shown on it.

Appendix C

Ethics Approval

UNIVERSITY OF CALGARY

CERTIFICATION OF INSTITUTIONAL ETHICS REVIEW

This is to certify that the Conjoint Faculties Research Ethics Board at the University of Calgary has examined the following research proposal and found the proposed research involving human subjects to be in accordance with University of Calgary Guidelines and the Tri-Council Policy Statement on *"Ethical Conduct in Research Using Human Subjects"*. This form and accompanying letter constitute the Certification of Institutional Ethics Review.

File no:	**4930**
Applicant(s):	**Saul Greenberg** Michael N. Nunes *Carman Neustaedter
Department:	**Computer Science**
Project Title:	**Sharing Photographs and Souvenirs in the Home**
Sponsor (if applicable):	**NSERC**

Restrictions:

This Certification is subject to the following conditions:

1. Approval is granted only for the project and purposes described in the application.
2. Any modifications to the authorized protocol must be submitted to the Chair, Conjoint Faculties Research Ethics Board for approval.
3. A progress report must be submitted 12 months from the date of this Certification, and should provide the expected completion date for the project.
4. Written notification must be sent to the Board when the project is complete or terminated.

Janice Dickin

Janice Dickin, Ph.D, LLB,

Chair
Conjoint Faculties Research Ethics Board

Originally Issued: 13 September 2006
Revised: 07 February 2007

Distribution: (1) Applicant, (2) Supervisor (if applicable), (3) Chair, Department/Faculty Research Ethics Committee, (4) Sponsor, (5) Conjoint Faculties Research Ethics Board (6) Research Services.

2500 University Drive N.W., Calgary, Alberta, Canada T2N 1N4 • www.ucalgary.ca

Appendix D

Publications

Materials, ideas, and figures from this thesis have previously appeared in the following publication:

Nunes, M., Greenberg, S. and Neustaedter, C. (2008). Sharing Digital Photographs in the Home through Physical Mementos, Souvenirs, and Keepsakes. In *DIS2008 Proceedings of the 7th ACM Conference on Designing Interactive Systems* (February 25-27, Cape Town, South Africa), pages 250-260, New York, NY, USA. ACM.

Appendix E

Co-Author Permission

May 16, 2008

University of Calgary
2500 University Drive NW
Calgary, Alberta
T2N 1N4

I, Carman Neustaedter, give Michael Nunes Permission to use co-authored work from our paper "Sharing Digital Photographs in the Home through Physical Mementos, Souvenirs, and Keepsakes" for Chapters 3, 4, 5, 6, 7, and 8 of his thesis and to have this work microfilmed.

Sincerely,

Carman Neustaedter

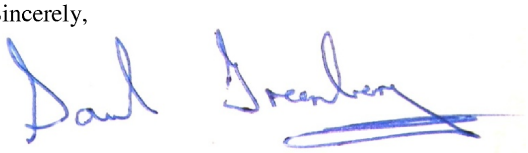
UNIVERSITY OF CALGARY

May 16, 2008

University of Calgary
2500 University Drive NW
Calgary, Alberta
T2N 1N4

I, Saul Greenberg, give Michael Nunes Permission to use co-authored work from our paper "Sharing Digital Photographs in the Home through Physical Mementos, Souvenirs, and Keepsakes" for Chapters 3, 4, 5, 6, 7, and 8 of his thesis and to have this work microfilmed.

Sincerely,



Saul Greenberg