Shoebox: Mixing Storage and Display of Digital Images in the Home

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ABSTRACT

This paper describes the rationale and design process for Shoebox, a "digital box" that combines the storage and display of digital images in the home in one unit. By combining these two functions in one, Shoebox attempts to bridge the divide between the location within a home where digital content is typically stored, and the means by which it can be put on display, as well as provide a form factor that encourages co-located sharing of images.

Keywords

Photo use, design, archiving, display, tangibility

INTRODUCTION

A growing body of research is highlighting the ways in which digital imaging technologies are changing our everyday practices with photographs. The ways in which photographs are captured, edited, managed, shared, displayed, and archived are fundamentally different depending on whether they exist in paper or digital form [e.g., 8]. Nowhere is this more obvious than in the home. Most households have both shoeboxes and drawers full of paper photos alongside burgeoning digital collections on various computers, or on the Web. The ways in which photos are displayed are also highly dependent on their form [12]. Treasured photos still tend to be printed, framed and displayed, while digital photos (less commonly) are displayed on PC screensavers or digital picture frames.

In this paper we describe a concept and working prototype called "Shoebox" which aims to explore notions of storage and display of images in the home through creating an amalgam of physical and digital affordances. The result is a device which at once offers storage and display for digital photos, but in a way that confers some of the benefits of

physicality too. We describe the development of the idea through a series of sketches, discuss how the concept was refined, describe the construction of the prototype, and discuss plans for future development. We believe this concept points to new classes of devices that cross the physical-digital boundary, and which may create new and compelling kinds of practices with photos in the home.
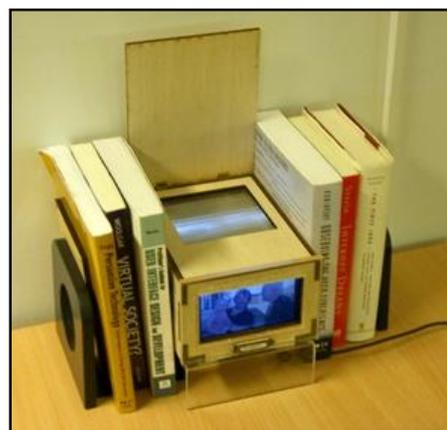

Figure 1. A working prototype of Shoebox on display on a book shelf.

RELATED WORK

Much of the work on photo use in the HCI literature has focused on the ways in which users struggle to archive and organize their growing digital photo collections. Many papers have offered up new kinds of tools to help people search through these collections, visualize them in different ways, tag them and organize them [see for example, 6; 7; 10 and 11]. However, as Kirk et al. [8] have discussed, with today's tools, there are many different kinds of activities that users engage in when dealing with their digital photos, prior to sharing them with others. All of this amounts to a great deal of "photowork". The upshot is that users tend to employ very simple schemes for organizing their collections, relying primarily on folders labeled with dates and events, and eschewing more complex ways of tagging or structuring their collections. Kirk et al. found that this tended to be "good enough", especially given that users usually wanted to share or print recently taken photos.

At the same time, Kirk et al. found little evidence for the use of digital means of sharing in co-located situations or display within the home. This is confirmed by a number of other researchers. For example, when it comes to display, Swan and Taylor [12] found that framed prints give material shape and form within the home in ways that reflect its social order. They particularly emphasize the differences in self-expression that come about through formal and deliberate placement of images, versus arrangements of photos that are more informal and unintended.

Further, Swan and Taylor also point out the disparity in the phenomenal growth in the sales of digital cameras, without a parallel growth in the development of novel and imaginative ways to display them in the home. Although the digital picture frame is growing in popularity they note that photo frames in a traditional sense are chosen for quite subtle reasons, to draw attention and add meaning to an image. In the case of digital picture frames this may be at odds with the random way in which images tend to be shown. That there is clearly a space to think more creatively about how digital images are presented in the home is confirmed and demonstrated through new concepts proposed not only by Taylor and Swan in [12] but additionally in [13] where they offer up the notion of a Picture Bowl. This concept follows research into clutter in the home, and was developed as a way of surfacing images in an ad-hoc fashion. This idea, and also the work of Durrant [3] and Tichenor and Mellis [14], provided a great deal of inspiration for what follows in this paper.

Similarly [9] Nunes et al. point out another disparity around the difficulty of sharing digital images in the home. Most of this investment in digital sharing tools has been for remote and online sharing. People now have many options to share their pictures with others who are not co-located, through e-mail and websites like Flickr [4], which have grown rapidly in popularity. Again, the co-located technologies for sharing have not grown at a similar pace.

This is further confirmed by Frohlich et al. [5] who have shown the ways in which paper photos provide a natural way to do "phototalk". This research also discusses the issues surrounding the sharing of digital images in a co-present situation, and points to the need to help users in the "socialization of digital photography".

Crabtree et al [2] also look more closely at the established practices of photo sharing with paper based images in a co-located situation. While they are primarily looking at how what they observe might be applied to distributed situations with digital content, their work is inspirational as a resource for designing digital interactions with photos in co-located situations. Their notion of a control centre is particularly interesting. As they state, "Here the members of the group orient themselves to the party who holds and controls access to the collection of photographs."

Another source for inspiration here is provided by Aipperspach et al. [1] who discuss the trend for homogenous homes, in which there's little distinction in use between different spaces. They emphasize how "Affording different opportunities to physically interact with the virtual home might allow us to be more reflective about and to discuss our electronic domestic artifacts as we manage them making the process more enjoyable and meaningful".

With these issues in mind, we wanted to explore ways in which we might take seriously the notion of "place" in the home environment when dealing with digital photos; ways that are situated and reminiscent of physical photos. At the same time, we wanted to incorporate flexible and dynamic methods of storing and interacting with photos within a form factor that would encourage co-located sharing.

INITIAL DESIGN IDEAS

With these goals in mind, the first step was to generate a series of sketches which explored some novel directions for digital photo presentation. We were interested primarily in developing three attributes for these objects:

- their ability to be placed in, and become part of, the home environment;
- their ability to be used for displaying and sharing images in that place, particularly storytelling of an event;
- and their ability to provide novel forms of interaction.

Each of the following ideas aims to do this by using the affordances of existing tangible objects that are already part of the home environment. Most are commonly associated with paper photos, and the explorations look at how some of the physical properties of those objects might apply to digital content.

The first idea, shown in Figure 2, is the concept of a digital photo flipbook that mimics a common photo album format, with images in two columns, each of which can be flipped through to show content. In this case we imagined that each leaf of the album would be replaced by a digital display.

Photo albums such as these are often kept closed on book shelves, and pulled down to share the contents with others. There's some drama in revealing each flap of the album, which helps control the pace of sharing with others. From a social perspective, this type of object might be good primarily for storytelling. Since albums are mainly closed, however, this form factor may not draw people in, becoming too much a part of the environment and disappearing from view.
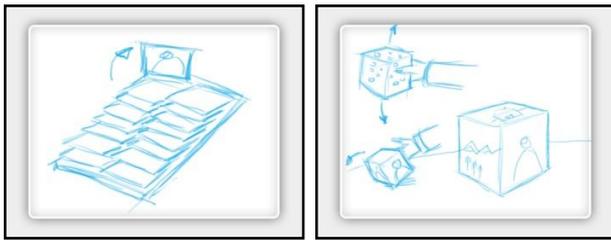
Figure 2(left). A digital photo flipbook.
Figure 3(right). A digital photo cube.

Similarly, Figure 3 shows another digital replacement for a pre-existing way of presenting paper photos, this time for a photo cube. These were common a few decades ago, with each face showing an image. In this sketch, the digital photo cube can be shaken to randomize its content, or can be navigated through by flipping the object on different sides (see also the Photo Cube concept in [12]).

This form seems to offer a great deal of possibility for interaction. It is eminently graspable, and could be tipped, rolled, and shaken. It can also have different activities or content associated with different faces and so on. It would also be the kind of object that could be kept permanently on display. However, it was felt that this object could feel a little *too* dynamic when it came to sharing and storytelling with others. The interactivity and multiple displays might be too much of a distraction when trying to tell a simple, chronological narrative of an event, for example..

Figure 4 shows a thumbnail sketch for a set of digital photo frames that create an eco-system to provide more interesting narratives, or different kinds of content, for an event. The frames work as a group, taking advantage of their digital nature to present items in a less linear manner. For example, while a couple of the frames might show photos of the event, others might show maps, comments and other kinds of content. Each frame might be customizable by its owner, providing a curatorial surface for them to show items of interest.

While this idea helps to take the slightly staid digital photo frame in a new direction, it is really optimized for presentation of content rather than interactivity. Photo frames are a little awkward to interact with, since it is difficult to pick them up and move them to a more comfortable location for storytelling. They are fairly fixed objects.
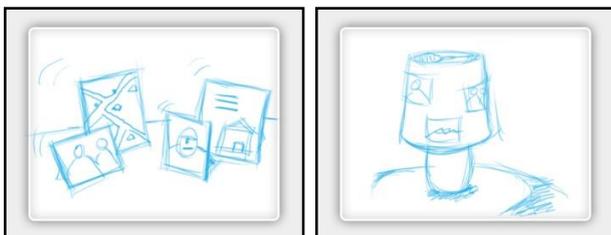

Figure 4(left). Networked photo frames.
Figure 5 (right). A photo lamp.

Figure 5 shows the use of a table lamp as a surface on which to present images, helping them become a diffuse part of the environment by exploiting an object that already helps provide "mood" for a room. This idea is interesting in that it is the most ambient of this set of sketches. However, while being potentially good at serendipitous display of photos, it would clearly be awkward for controlled storytelling, and could be an difficult surface on which to interact.

Figure 6 shows the original thumbnail sketch for Shoebox which was inspired by both the use of real shoeboxes in the storage of paper images, as well as the idea of using images on their side as a means of navigation (see interface details below), an action that is similar to riffling through the pages of a book.

Following the development of this set of concepts, as well as others, Shoebox was chosen as the subject for further design work. It was selected primarily because:

- The placement of a display at one end of the box offers a surface that could be permanently on display. It isn't hard to imagine this object stacked on a bookshelf, presenting its content continuously while not in use.
- The form factor is one that could be lifted down and shown to others. The use of a single display provides some sense of control over content when storytelling.
- A "riffling" action on the top of the Shoebox is an interesting one to explore. The linear nature of the action feels like one that can aid in storytelling.
- The form factor of a box offers an additional notion: that the content itself lives primarily "in" the device rather than being a copy of content kept on a machine elsewhere.
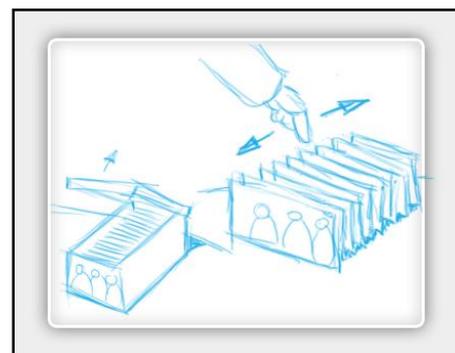

Fig. 6. Shoebox.

DESIGN OF SHOEBOX

These initial criteria for selection became dimensions that we wanted to explore and incorporate into the design. We examine each in more detail, describing how we decided to achieve each of these design goals.

Display for the home

Given the extent to which digital images matter to people, in some ways it is doing these treasured items a disservice to ask that they be stored away in an object like a personal computer, which is hard to access, difficult to move, and focused, from an activity perspective, on storage and management rather than presentation and consumption. They should instead be stored in a way that honors the content, which makes it feel precious. As highlighted in [12] there is a great deal of subtlety in the ways in which paper photos can be arranged and displayed, and Shoebox aims to provide one means for people to make similar choices for digital content.

Shoebox is designed to give a sense of emphasis, of honoring, to digital content by surrounding it with an object that has aesthetic and production value. Shoebox is not designed to look overtly technological. Instead it is designed to fit more naturally into a household than many other technological objects which look awkward and out of place. It is intended to be an object in which people can be proud to store their images, and which gives those images extra emphasis through the form of containment (see Figure 7 for a range of Shoebox designs).
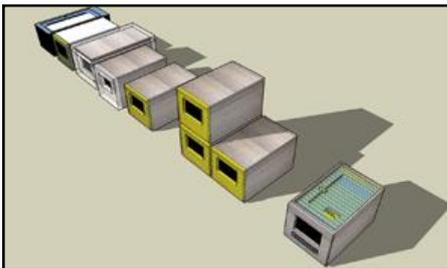

Figure 7. A range of designs for Shoebox.

Simplicity of use

Shoebox is intended to be very simple to use, therefore we wanted its range of interactions to be quite limited. Its primary components are an internal processor, wireless functionality, a hard drive for image storage, a display on the front for presentation of images, and a touch-sensitive surface on top of the device for navigating content chronologically.

Figure 8. Still from a mockup video showing the transferring of content between a cellphone and a Shoebox.

Shoebox gets its content from wireless devices, particularly mobile phones, with which it is associated. Placing these devices within range automatically starts the process of copying content onto Shoebox. Figure 8 shows a still from a concept video showing new photos being transferred from a cellphone to a Shoebox. As new images arrive on the Shoebox they are shown "dropping into it", through its display.

Flexible archiving for sharing

Digital photos are typically stored on a personal computer in a hierarchy of folders. Each folder is very commonly labeled by the date or event at which its content was taken [e.g. 8]. Being able to store photos this way allows individuals to tell stories around the content, about what happened at a particular event for example, in much the same way as they can around the contents of an envelope full of printed photos.

Although it has the capacity to store many images, we are exploring this association between photos and events by allowing people to label their Shoeboxes. This is enabled in a deliberately low-tech manner, through the use of a paper label holder mounted to the front of each box. Doing this in paper makes it very easy to assign a label to the content without any of the potential complexities of a more technological labeling solution. (see Figure 9).

It is hoped that this simple affordance encourages people to think more carefully about how the photos they place into Shoebox relate to one another.

Figure 9. Labeling a Shoebox.

Figure 10. A set of Shoeboxes.

Through this association between a Shoebox and a specific event it is possible that households might have multiple of these photo containers, each of which belong to a different person, event or period in time. See Figure 10.

Story-telling through simple interaction

Shoebox is intended to be a device that can be picked up and used to tell the story of a particular event or chronology of images. It can be placed on a table or lap, and its content navigated using a touch-sensitive surface.

Users interact with the content through a touch-sensitive surface on top of the device. Running a finger along the surface on top of the device is intended to be an analog to riffling through a set of paper photos (see Figure 11). This interaction is also inspired by the Box of Sound prototype developed by Tichenor and Mellis. Newer photos are accessible by touching the front of the surface, nearest the display, with other images ordered chronologically towards the back.

Figure 11. Navigating through the contents of a Shoebox.

Feedback is given through a moving LED mounted on a motorized slider (see implementation section below). This gives the interaction a real sense of tangibility since you can hear and feel the motion of the light in response to the movement of your finger.

Photos "live" in the device

Finally, we wanted to reinforce the notion that photos "live" in Shoebox, even if the device could be built such that the contents are automatically and wirelessly backed up on the network. The rationale here has to do with the commonly held belief that if someone's house was on fire, they would first save their family, and then they would save their photos. This implies that people want the reassurance of knowing where there photos are, and that they could get their hands on them in a hurry.

Shoebox aims to provide an answer to the question of where this important content lives. In this sense it provides some reassurance about the security of their content, since it is now part of their environment, as well as providing an object to grasp in an emergency.

Shoebox provides users with a place in which to drop off their digital pictures that is easily accessible. It contains a hard drive and Bluetooth technology to allow the quick syncing of content into it. Because it also has a screen built into it, photos that are placed within it are immediately put on show in the home without the burden of moving the content from a dedicated storage device to a separate one that displays the pictures. In Shoebox storage and display are one and the same.

IMPLEMENTATION

Hardware

A working prototype for Shoebox has been constructed (see Figures 1). The display, processor and storage were all provided in one unit by using an OQO miniature handheld computer. The prototype has a touch sensitive overlay mounted on top for interaction, under which are mounted some acrylic light "pipes" which are lit using an LED, and give the user a sense of their interactions by lighting up different portions of the area under their finger as it moves.

The LED light source under the touch screen is actually mounted on a motorized fader controller, similar to those that you might see used in a modern audio mixing desk. It is this controller that moves the LED along to light the correct area under the persons finger.
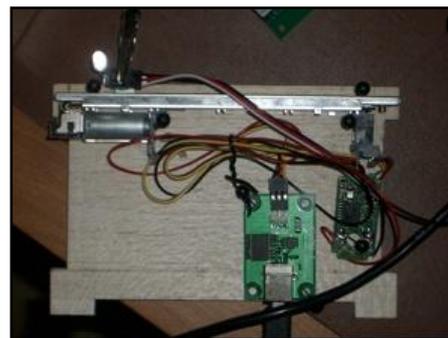

Figure 12. The LED mounted on the slider controller (top), and Arduino controller (bottom right).

This is obviously slightly over-engineered, since an array of LEDs could have been used instead to provide light at different points, but the whir of the motor and the motion of the LED give a really pleasant, mechanical, almost haptic feel to the device. The slider controller is interfaced with the OQO through an Arduino micro-controller.

User Interface

The user interface has two modes – slideshow or navigation. After a period of inactivity, Shoebox automatically starts a slideshow of the images that it contains, showing items randomly selected from the pool.

As soon as someone lifts the lid on Shoebox and touches the touch sensitive area the device switches into navigation mode.

Figure 13. User interface during navigation.

Figure 13 shows the user interface during navigation which, like the device itself, is quite simple. As the user moves their finger across the top of the box, the images on the front change, and a number shows up briefly, which fades away after a few seconds. The number helps give them some sense of the total number of items contained on the Shoebox, and how far they are through them.

NEXT STEPS

From the prototype we have built, we can get a sense of how the content might be displayed, and what the navigational experience is like. We have also been able to engage people through showing and demonstrating it. People understand the concept immediately, and are able to interact with it easily in terms of navigating through the content. The simplicity of its design and its aesthetics also seem to fit well in a home setting, satisfying us that we have achieved at least some of our design goals.

However, although we now have this "proof of concept" prototype, it is not currently wirelessly-enabled. This means it is not yet at a stage where we can begin to upload people's personal content, enabling interaction with the device in a real home. It is possible that in the short term we may add a set of memory card slots to the device, so that items can be transferred over to it manually. This would allow subjects to use normal digital cameras for capture, rather than relying on other wireless devices.

Following the addition of this piece of functionality to the device it is hoped that we can begin to undertake at least a small-scale deployment to get an early sense of its potential use and value before refining the prototype, possibly building additional systems, and deploying more widely. Ultimately, this concept we intend to be one of a wider set of digital concepts which will form a new ecosystem of devices for more compelling ways to display and store the digital materials that are most precious to us.

ACKNOWLEDGMENTS

REFERENCES

1. Aipperspach, R. Hooker, B. Woodruff, A. The Heterogeneous Home. http://www.benhooker.com/heterogeneoushome/ (2007).

2. Crabtree, C., Rodden, T. & Mariani, J. (2004). Collaborating around collections: Informing the continued development of photoware. In Proc. CSCW 2004, ACM Press (2004). 396-405.

3. Durrant, A. et al. Speculative devices for photo display. In Proc. CHI 2008, ACM Press (2008). 2297-2302.

4. Flickr photo sharing website. http://www.flickr.com.

5. Frohlich, D. et al. Requirements for Photoware. In Proc. CSCW 2002, ACM Press (2002). 166-175.

6. Huynh, D. F., Drucker, S. M., Baudisch, P. and Wong, C. Time Quilt: Scaling up Zoomable Photo Browsers for Large, Unstructured Photo Collections. In Proc. CHI 2005, ACM Press (2005),1937-1940.

7. Kang, H., Shneiderman, B., .Visualization Methods for Personal Photo Libraries: Browsing and Searching in the PhotoFinder. In Proceedings of IEEE International Conference on Multimedia and Expo (2000).

8. Kirk, D. et al. Understanding Photowork. In Proc. CHI 2006, ACM Press (2006), 761-770.

9. Nunes, M. et al. Sharing Digital Photographs in the Home through Physical Mementos, Souvenirs and Keepsakes. In Proc. DIS 2008. ACM Press (2008). 250 – 260.

10. Rodden, K. and Wood, K. How do people manage their digital photographs? In Proc. SIGCHI conference on Human factors in computing systems 2003, ACM Press (2003), 409 – 416.

11. Shneiderman, B., and Kang. H. Direct annotation: A drag-and-drop strategy for labeling photos. In Proceedings of the International Conference on Information Visualisation, IEEE, (2000), 88–95.

12. Swan, L. and Taylor, A. Photo Displays in the Home. In Proc. DIS 2008, ACM Press (2008), 261 – 270.

13. Taylor, A. et al. Homes that make us smart. In Personal and Ubiquitous Computing, Springer-Verlag (2007), 383 - 393.

14. Tichenor, J. and Mellis, D. Feel the Music/Box of Sound.http://www.jamestichenor.net/stuffer/feelMusic/feelMusic07.html. (2004)