Sound, paper and memorabilia: Resources for a simpler digital photography

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1. INTRODUCTION

Domestic photography, in the west, is undergoing its most radical change since the introduction of the Kodak box brownie camera in 1900. The process of private analogue film exposure and professional film development ('you press the button, we do the rest'), is giving way to a range of alternatives made possible by digital imaging technology. These include private home printing, self-service or web-service printing, development onto CD-ROM, electronic archiving, transmission and publishing of photographs, photo manipulation, and photo viewing on every possible kind of screen. Furthermore the incorporation of camera features into other devices such as mobile phones, PDAs, camcorders and MP3 music players is expanding the context and volume in which photographs are taken and leading to their combination with other media and activities. As an example of an area in which consumers are led to think that 'More is More', digital photography is just about perfect.

In this paper we present a body of work to develop a simpler and more reflective form of digital photography. We give three pairs of examples of 'Less is More' thinking and design which are made possible by new technology, but directed and inspired by user behaviours and reactions. Each pair of examples happens to review the place of an old technology in the new scheme of things, and challenges a technological trend in the industry. Hence, we consider the role of **sound** in photography to recommend audiophotographs rather than short video clips as a new media form. We look again at the role of **paper** in photo sharing and recommend its support and augmentation against the trend towards screen-based viewing. Finally, we consider the role of physical **memorabilia** alongside photographs, to recommend their use as story triggers and containers, in contrast to extensive photo-video narratives. All these ideas were generated through close attention to current-day practices and needs in domestic photography, and yet have been productive in developing novel trajectories for simple designs. We take up this theme at the end of the paper to draw out some design lessons for simple computing.

The inspiration and structure for this paper come from a similar article published 9 years ago as a two page note in a conference proceedings. Strong and Gaver (1996) outlined three novel concepts for supporting simple intimacy in mediated communications. Each involved pairs of devices used by remote partners to let one partner know the other was thinking of them. Hence, 'Feather' comprised a picture frame which, when picked up, caused a fan to blow a feather into the air inside a glass container. 'Scent' used the same picture frame to trigger a burner to come on beneath

a bowl of essential oil, releasing a lingering aroma. 'Shaker' comprised a pair of handheld devices which transmitted a shaking motion in one device to the other. What was unique about these concepts at the time was their recognition of a core truth about human communication that was overlooked by the myriad voice-and-data facilities of other CSCW systems: that it involved expressions of emotional intimacy conveyed through the most minimal of non-verbal cues. In fact, this insight was a reminder that CSCW systems were *about* supporting human and humane communication, rather than all the complex activities that had come to characterise use of the technology. In the same way, we would like to call attention again to what digital photography systems are about, and to use this insight to populate a new design space by example.

2. DOMESTIC ICONOGRAPHY AND DIGITAL PHOTOGRAPHY

Digital photography systems are about the support of domestic photographic behaviours, which themselves relate to fundamental processes of memory, narrative and identity. Photographs happen to be one particular record or token of experience, which people seem to find useful for remembering that experience, reflecting on it, displaying it, and talking about it. In the absence of other theories of domestic photography, Frohlich (2004) has proposed a framework for thinking about the activities in photography as an interplay between the photograph, the photographer, the subject and the audience. This framework is reproduced below in Figure 1. It shows that half the activities, shown as dotted lines, involve different kinds of solitary reflections on the photograph by the various human participants. The other half, shown as solid lines, involve different kinds of three way interactions between participants around the photograph. In this view, memory is something which happens individually on review of a photograph, but also socially and collaboratively in interaction. Narrative is a form of interpretation an audience can read into a photograph, or a story that can be told from a photograph by a photographer or subject. And identity is both something that is seen in a photograph of oneself as subject, or deliberately presented to others for interpretation and response.

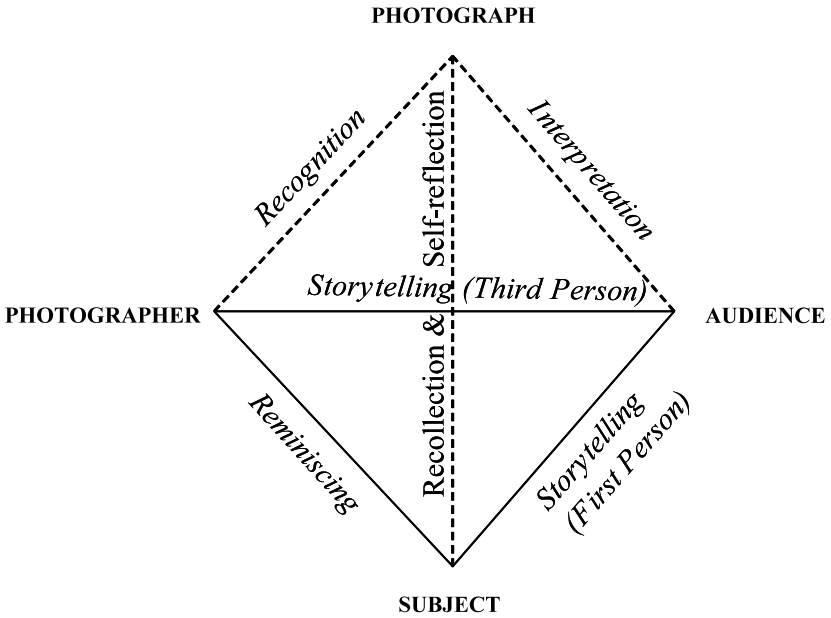

Figure 1. The diamond framework for domestic photography (Figure 3.5 in Frohlich 2004, p44. Reprinted with permission).

Going beyond this conception of photography, we note that other records of experience can substitute for photographs in the framework. Sounds, textures and scents can trigger memories or interpretations in individual participants, and even serve as talking points for reminiscing or storytelling conversations. Composite records such as video or 'audiophotos' serve a similar function, - albeit with different properties and affordances for behaviour (see again Frohlich 2004). Finally, objects can substitute for photographs in the framework, whenever they come to be associated with an experience or identity. We define such objects as *memorabilia*, since they stand as a token of experience without being literal records of that experience. In this broader view, it becomes harder to refer to the spectrum of activities involved as 'just photography' since other media have expanded the **forms** of behaviour within the framework. However, we argue that the dynamics of the interactions within the diamond remain the same, and continue to refer to something of what people do when they use tokens to manage memory, narrative and identity. For want of a suitable label, let us call this activity *domestic iconography*. This refers to the use of visual and non-visual icons in mediating personal narratives.

Given this reminder of what digital photography should be about, how does it actually measure up? More specifically for the theme of this book, what are the assumptions underlying the kind of more-is-more philosophy in the industry, and are they justified in terms of supporting what we have called domestic iconography?

Taking the first question first, we can say that the new digital photography products being used today make it easier than ever to capture photographs in volume, to review the results more quickly and share the images more effectively than before. In fact, there seems to have been a shift in focus from the support of personal capture and consumption of photographs printed out at home, to the capture and sharing of screen-displayed photographs through *photoware* (Frohlich, Kuchinsky, Pering, Don & Ariss 2002). This has happened within the photographic paradigm with digital cameras and the internet, but also within the telephone paradigm with the advent of cameraphones and multimedia messaging (Koskinen, Kurvinen & Lehtonen 2002). There has also been a convergence of camera and camcorder functionality such that most capture devices now support photographs and video, with audio thrown in as a bi-product of video. Since digital cameras are still cheaper and more popular than digital camcorders, the emphasis remains on still images as the primary recording form, with short video clips emerging as a secondary form alongside them. This is reinforcing the screen-based orientation of 'playback' and leading to a reduction in the proportion of photos that are printed. Interestingly, the same number of photographs are still being printed worldwide, because the overall number of photographs captured has gone up (Worthington 2004). This analysis suggests that people have been presented with a variety of new options for performing many photographic activities in Figure 1, especially the screen-based sharing of images. However, little has been done to encourage more general iconographic activities with other media, apart from the provision of short video capture on cameras.

Implicit in these trends are a number of assumptions about what is good for the consumer. These are variations on a general more-is-more philosophy to provide the largest number of features at the lowest possible price. One assumption seems to be that **the additional realism of video is preferable to photographs** as a record of

experience, all other things being equal. This can be seen in the attempts to increase the quality of video on still cameras at fixed cost, and decrease the cost and size of camcorders themselves. Much effort is also being put into the provision of new digital video editing software and storage solutions, to further encourage an upsurge in video capture. In the cameraphone arena, digital video is a major driver for 3G applications. Another assumption is that **screen-based display and playback of media is preferable to printing photographs** because it increases the convenience and impact of images at lower cost. This can be seen in the provision of photo and video browsers on all kinds of platforms, from the LCD on the camera or phone, to software for the PC, Mac, TV, projector, media player and gamestation. On certain platforms like mobile phones, image capture and display was made available prior to any printing solution – expecting the user to figure out how to move the images to another platform from which to print. Finally, there is an assumption that **increasing the coverage of photo and video is a good thing in itself**, so that consumers are able to capture and look back on more candid and complete records of their lives. This can be seen partially in the promotion of video over photo records in which the frame rate is much higher, but also in the movements to develop ubiquitous and wearable cameras. Situated cameras at theme parks currently offer photographs the subjects could not have taken themselves, while wearable camera prototypes promise always-on video, slow burst stills or photographs triggered from contextual events such as laughter (e.g. Gemmell, Williams, Wood, Lueder & Bell 2004). Photography in this view would become more about consumption than capture, and the navigation of large media repositories representing entire life histories.

In the rest of this paper, we critique each assumption in turn as a way of introducing a less-is-more alternative. The critiques are based on a series of user studies addressing these issues from a consumer point of view. In each case we present two design concepts embodying the alternative view and suggesting new approaches to design which might be developed by others.

3. VIDEO REALISM AND THE ROLE OF SOUND

Although video undoubtedly captures more of the experience of an event than a photograph, it does not follow that a video clip serves as a better trigger for memory, narrative or the presentation of identity. We can see this quickly from a number of technical contrasts between the media. Symbolically, the selection of a key moment in an unfolding experience can represent that experience in a single frame – as in the blowing out of candles on a birthday cake. Aesthetically, a still image points back in time and causes the viewer to search for an explanation, whereas a moving image points forwards to a different narrative question of what will happen next (Berger 1982). Interactively, the watching of a video sequence is passive and paced by the real-time development of the action, or the directors cut. In contrast, photographs are usually consumed actively at a pace controlled by the viewer. Psychologically, video is a *hotter* medium than photographs because it contains a higher density of information and requires the viewer to do less interpretive work to understand the content (c.f. McLuhan 1964). All these differences are potentially important when considering which medium is best for what activity in the framework of Figure 1. More clues about whether video is preferable overall come from empirical studies of video use and direct preference contrasts.

Somewhat surprisingly, very little has been published about domestic video use and how it is changing with digital technology. In an unpublished study carried out in HP Labs, Budd (1996) found a great disenchantment with analogue video by camcorder owners, and a lively market in second hand devices. The owners complained of recording too much material and not having time to edit or index it. They also felt more distanced from the original event by filming it rather than participating in it themselves. This had led many to stop using their camcorders, and to neglect watching the video archive they had collected. In contrast, a parallel study of analogue camera owners found that they were largely satisfied with their cameras and quality of photographs they produced (Geelhoed 1996). Problems of organising and archiving photographs were mentioned, but these did not prevent home photographers from using or enjoying them.

A different set of trade-offs were reported in a study by Chalfen (1998). He interviewed 30 teenagers about their attitudes to home video versus photographs. The teenagers reported that video was better than photos for re-living the event, since the records were more detailed and realistic. However, they also felt that video was *too* real to allow room for thinking and talking about the past with others. In other words, the hotter 'temperature' of the video medium referred to above, was seen as a disadvantage in terms of reflecting on a memory or telling a story about it. This led Chalfen to conclude that 'less is better' in respect to this contrast (p174).

In a follow-up study to the camcorder and camera surveys cited above (Budd & Frohlich 1996) uncovered latent interest in a middle ground between photos and video. Four consumer focus groups clustered by age and gender, responded consistently well to the idea of attaching sounds to photographs. In fact sound was perceived to be the most attractive media type to combine with photos, compared to handwriting, text or even short video clips. This is because it was seen to have a variety of uses, including adding atmosphere with ambient sound, increasing nostalgia with music, and attaching a voice message with narration. This made us wonder how much of the realism of video was actually provided in the audio stream, and whether a new *audiophoto* combination might be better than video for memory and storytelling.

This possibility was tested in a subsequent audiophoto trial (Frohlich & Tallyn 1999, Frohlich 2004 Chapter 4). Four families were given audiocamera units on their summer holidays, on which to record arbitrary combinations of still images and sound clips. The resulting audiophoto albums were shown back to the families for comment and discussion. The main finding was that ambient sound rather than voice commentary was the most attractive form in the corpus, and that this enhanced the memory of the event compared to a photograph alone. It also added atmosphere and interest for audiences of the photograph, and enlivened reminiscing conversations about the event. When asked about the contrast between audiophotos and video, 11 out of 14 participants chose an audiocamera in preference to a camcorder. This was because they used the trial unit more like a point-and-shoot camera than like a conventional camcorder, paying careful attention to the framing of sound clips with images and keeping the duration of clips down to about 24 seconds. This allowed users to participate in the event to a greater extent than they might have done with video, and resulted in more professional effects that were not seen to need editing. In short, combining sound with photographs appeared to carry many of the benefits of video without the usual costs.

These insights eventually led to a number of novel design proposals and prototypes for possible audiophoto products. We present two examples here, representing an audiocamera and a storage format for audiophotographs. The audiocamera is shown first in Figure 2.. It was an HP Labs prototype built in 2000, designed primarily for testing CMOS sensors and never intended for commercialisation. However, it was also used to explore a new model for audiophoto capture, using a forward-facing microphone and a dedicated button for sound capture. The idea of using two buttons for concurrent sound and image capture led to the camera's code name *Blink*. The sound capture button was positioned on the top edge of the unit opposite the image 'shutter' button, to fall under the user's left index finger. It could be operated like a dictaphone to capture sentimental ambient sounds alone, or held down across one or more shutter button depressions to generate simple audiophotos or audiophoto slide shows. As the camera itself had no LCD screen or speaker to review the results, it was designed to dock to a PC and automatically upload a mixed photo, audio and audiophoto album to a website. Although this digital audiocamera unit was never developed into an HP product, several of its interface design features were patented and/or later found their way into camera products. For example, all HP cameras currently support ambient audiophoto capture through a combined sound-and-shutter button. This can be held down after the photo has been taken to append sound to the jpeg file, until released.

Figure 2. The *Blink* digital audiocamera

While the initial audiophoto trial suggested that ambient sounds were the most attractive kinds to combine with photographs on a camera, further studies suggested that voiceover, music and recorded conversation might be added to good effect later. Hence, voiceover messages were found to contextualise photographs for remote recipients, music was found to add emotion to images, and conversation about the photograph was found to contain useful personal reminders of the event (Frohlich 2004). This eventually led to the idea of a multilayered audiophoto containing four different types of sound that could be muted or merged at playback time, depending on the requirements of the playback context. This concept is illustrated in Figure 3 which shows a complex audiophoto displayed in a frame. On a screen-based device, the user would be able to select an edge to toggle on or off each of the four different sound types. Ironically, this goes far beyond what might be recorded or represented in a simple video clip, and requires a new kind of complex data format for storage. Patents applications and specifications for this format have been fed into a new DVD standard called multiphoto video or 'mpv' for short (http://www.osta.org/mpv/public/index.htm).

Figure 3. The multilayered audiophoto, containing ambient sound, voiceover, music and conversation (adapted from Figure 9.4 in Frohlich 2004)

4. SCREEN-BASED PRESENTATIONS AND THE ROLE OF PAPER

Screen-based display and playback of photographs and video is indeed popular today, not least on the back of digital cameras and cameraphones. Indeed it could be argued that immediate review and sharing in the moment are two of the biggest advantages of digital photography over analogue photography, together with remote transmission of image-based material. Such transmission itself results in further screen-based review, either on the back of a receiving cameraphone, or on a computer screen with email or web access. However, these behaviours do not lead to the conclusion that printed photographs are dead, or that further screen-based viewers will automatically be preferred to paper.

In fact consumers appear to be printing the same absolute number of photographs as they always did. It is just that they are taking and reviewing on-screen a greater volume of images overall (see again Worthington 2004). So printing is getting more selective. Furthermore, consumers are choosing to ignore a number of facilities and products for further screen-based review. These include electronic photo frames, electronic books and photo-based media viewers. These products have yet to be adopted by the mass market. Even the playback of photographs on TV has been slow to take off, given the possibility of direct connection from most digital cameras, and the trend towards DVD storage of photographs.

One reason for the persistence of prints is the inaccessibility and vulnerability of digital photos across a variety of devices and storage media. This is a real problem long term, since those devices and formats may become obsolete over time. Even in the medium term, photographs can be difficult to locate and manipulate within an electronic repository (e.g. Kuchinsky, Pering, Creech, Freeze, Serra & Gwizdka 1999, Rodden & Wood 2003). Physical photographs in packs or albums have the advantage of being associated with particular locations in the home. They are also bounded and indexed by their packaging and design, and can be browsed quickly by direct manipulation. Electronic photographs can be given some of these properties, but only by clever software and interface design (e.g. Bederson 2001, Vroeginderwejj 2002).

Another reason for the persistence of prints is the way in which they can be shared in conversation. As with printed work documents, photographs can be spread out and compared, annotated, shuffled and handed around (O'Hara & Sellen 1997). These properties are likely to be important for conventional photo sharing conversation, which is highly interactive and responsive to audience participation. Hence, in a study of printed *photo-talk,* 11 families self-recorded 81 naturally-occurring photo sharing conversations on audiotape, and filled in photo diary entries for each session (Frohlich et al 2002, Frohlich 2004 Chapter 7). The majority of these conversations were between partners who shared the memory of the event depicted in the photographs, and were so interactive that it was not appropriate to describe one or other partner as leading the conversation. Such *reminiscing* conversations, involved a kind of shared participation in which each partner chipped in comments in an ongoing discussion of the material, often in overlap with each other. Other conversations involved *storytelling* to people who did not share the memory depicted in the images. These were more directed by photograph owners, but still involved interruptions, questions and contributions from the audience who appeared to direct the conversation to photographs of mutual interest. Both kinds of conversation were quite unlike the linear slide-show model of photo-talk encouraged by digital photo-album software. This was because the tangibility of the photographs allowed the image presentation and conversation to get out of synch' with one another. This created opportunities for the participants to look back or ahead of the narrative, and to seize control of the images or conversation.

Thus, despite the advantages offered by screen-based photographs and multimedia variants, consumers are reticent to give up the beauty and simplicity of tangible prints. These provide a reliable method of accessing and managing images, and lead to highly interactive modes of sharing them. Building on these insights, and those already mentioned on the value of sound with photographs, we have begun to explore ways of augmenting printed photographs with sound that can be played back from paper *audioprints.* Figures 4 and 5 show two alternative approaches that are offered here as further examples of less-is-more thinking in this domain.

Figure 4 shows a printed photograph with an embedded chip in the paper, capable of encoding up to 30 seconds of high quality sound. A handheld *audioprint player* is then used to contact the chip and playback the sound. The sound is recorded into the chip either when the photograph is printed, or when it is inserted into the player. In the first case, an existing audiophotograph (recorded on an audiocamera or PC) can simply be 'printed' on an audio-enabled printer loaded with special paper. In the second case, a silent photograph can be printed in the same way, and later annotated with sound using the handheld player in record mode. A working version of this prototype was build and tested in HP Labs Bristol in 1999, and has now been successfully patented (e.g. Frohlich, Adams & Tallyn 2000). Although, this concept involves a dedicated handheld photograph player, the same functionality could technically be built into a range of existing devices such as cameraphones, MP3 players and PDAs. Alternatively a whole family of specialised audiophoto players could be created to include audio-enabled albums, frames and cards. When some of these options were demonstrated to families in subsequent studies, alongside a variety of screen-based viewers, families rated **all** options positively (Frohlich 2004 Chapter 8). This confirmed the value of paper-based playback as expected, but also showed

that consumers wanted to move back and forth between different forms of paper and screen displays for particular purposes and contexts.

Figure 4. The audioprint player (Figure 3 in Frohlich, Adams & Tallyn 2000 reprinted with permission).

Figure 5 shows a digital desk with an overhead camera and speakers instead of a projector (after Wellner 1993). The camera is used to recognise printed photographs placed on the desk surface and play their associated sounds from a PC under the desk (Frohlich, Clancy, Robinson & Costanza 2003). Audiophotos are loaded into the PC on a CD-ROM containing jpeg and wav files with the same filename, and the system works from nothing more than regular jpeg prints displayed within a white border. Multiple prints will play at the same time and the system keeps track of the position of prints on the desk. When any print is pushed away from the user towards the top of the desk it plays more quietly, while moving it left or right across the desk shifts the balance of playback from the left to the right speaker. Users can therefore playback an audioprint automatically with no other interface than the print itself, and physically mix a complex soundscape from a pack of photographs simply by changing the print arrangement on the desk. In contrast to the audioprint player, the desk allowed users to assemble a combination of sound and image clips which could be mixed together at playback time. This gave the output some of the qualities of the multilayered audiophoto in Figure 2, especially when different types of sounds were associated with photographs from the same event. These qualities were exploited in a subsequent trial of the desk, in which users tried to design audiophoto collage material for interactive performance (e.g. Lindley & Monk 2005). Such effects would be difficult or impossible to achieve on screen., and seek to preserve the highly interactive nature of photo-talk.

Figure 5. The audiophoto desk (Figure 1 in Frohlich, Clancy, Robinson & Costanza 2003 reprinted with permission.

5. PHOTO COVERAGE AND THE ROLE OF MEMORABILIA

One of the things that is changing with digital photography is a shift in the coverage of photographs over a lifetime. Whereas analogue photography used to be reserved for special occasions such as weddings, parties and holidays (e.g. Chalfen 1987), digital photography is beginning to catalogue other areas of life such as working events, shopping trips and domestic routines. This trend is exaggerated by the growth of photo sharing behaviours, which means that individuals are now receiving many more photographs of themselves or their friends that they never took. The industry continues to encourage more casual and automatic forms of image capture through situated and wearable cameras, without really addressing a couple of key questions. Do people want all these images and what will they do with them when they have got them?

It is possible to be sceptical about an answer to the first question by considering the second. We know something of what consumers do with their photographs now, both privately and in communication with others. Families currently struggle to organise their analogue and digital photographs and tend to archive the majority with very little intervention. A basic sort appears to be done on new images to distinguish good from bad, or best from the rest, so that further organisation and sharing activities are carried out from the good set (Rodden & Wood, Frohlich et al 2002). Good photographs may then be assembled into temporary or thematic albums, usually in chronological order, but families quickly fall behind with this activity. Beyond that, individual photographs or small sets of images tend to be singled out for special attention. Favourite photographs will be framed for display on their own or in a collage. Images will be emailed to others, alone or in small coherent groups. Even when whole sets of photographs or albums are shared in conversation, storytelling tends to spring off individual images rather than developing over a narrative sequence of images. This

can often be about things that are 'off-frame' and not depicted in the images themselves - as in the story of a racoon-infested camp site which was triggered by a picture of another camp (Figure 7.12 in Frohlich 2004). In the cameraphone context more unusual images are taken, but often with the intention of showing or sending them once to particular people (Kindberg T., Spasojevic M., Fleck R & Sellen A. 2004).

So the use of photographs today involves a series of reductions on the total collection, often down to individual images which epitomise an entire trip, a relationship or a story worth telling. As an aid to memory, narrative and identity management, the camera might be likened to a notepad and pen which are used to take notes useful for each activity. The deliberate and selective taking of pictures *as* notes, is likely to be important for subsequent recall of the depicted events, and for their use in storytelling and display. And the review of captured pictures for these purposes will be easier if the picture-notes are sparse but succinct. This analysis leads to the view that consumers do not need more images which are captured and organised for them, because this would be like being handed reams of unprocessed notes which somebody else had written. Instead they need almost the opposite: fewer images of more personal significance that can be accessed easily in a range of situations.

To explore this notion further we began to examine the role of framed photographs and other memorabilia to be found on display or stored away in the home. Working initially with the blind, we tried to understand the role of objects in remembering and sharing the past (Fennell & Frohlich 2004). Surprisingly, we found that framed photographs were still important to people who had lost their sight gradually with age, trauma or disease. This was illustrated most dramatically by one participant who told us she would sometimes touch a framed photograph on her wall, in order to remember what it looked like. This shows that the frame itself had become a reminder of a visual memory of the image it contained. In the same way, a great variety of other objects and things had come to stand for images, scenes, people and events in the 'mind's eye'. These included ornaments, jewellery, clothes, furniture and framed photographs, but also music, food, perfume and other people. In some cases, these items had developed strong associations with the past 'accidentally', through extended use. In other cases, memorabilia items were purchased or received with a specific association. This was the case with gifts and inherited objects which were linked to their original owners, and souvenirs bought on holiday which were linked to their place of purchase.

The placement, storage and display of memorabilia turned out to be an important factor in how they were used. Displayed items were selected and placed for easy personal access and with visitors in mind. Stored items were more private, and seemed to build up without explicit selection in some of the most inaccessible parts of the house such as the attic. Ironically, we found that people habituated to the nostalgic value of displayed items so that they seldom thought about their associations until prompted to consider them again by a visitor or some re-organisation of the house. In contrast, the surprise discovery of a forgotten item in storage resulted in a powerful form of reminiscing. Sometimes a single item would result in a whole chain of memories flooding back, with an accompanying burst of explanations and stories to the interviewer. Storytelling itself appeared to be integral to the remembering process. Memorabilia only appeared to come to life in the minds of the participants when they

began to tell us about them in the interviews. They appeared to relive the memories through this telling. Conversely the memories and stories lay hidden in the object when it was not discussed. In subsequent work, sighted participants were asked to write down the story of sentimental objects on a postcard (Fennell 2005). Although brief, these were often deeper and better formed than stories told about photographs. For example, they contained a small number of recurring themes including rescues, achievements, first occasions and gifts, and sometimes finished with a moral lesson. This concurs with recent attempts by BBC Wales to improve digital storytelling by asking participants to bring in memorabilia items rather than old photographs and video clips (Morlais 2005, personal communication).

Figures 6 and 7 show two novel ways of supporting this kind of storytelling with objects. These serve as examples in a new design space of augmented memorabilia, which has been almost completely overlooked by the digital photography industry. Further examples are to be found in Fennell & Frohlich (2004), Fennell (2005) and related publications (e.g. Aats & Marzano 2003, Frohlich & Murphy 2000, Gaver & Martin 2000, Hoven & Eggen 2003, Stevens, Abowd, Truong & Vollmer 2003).

Figure 6 shows a *memory shelf* based on the idea of an augmented mantelpiece. Sentimental items on the mantelpiece can be moved to a weighing platform at one end to have their associated stories recorded or played back. Stories are recorded verbally at the shelf by pressing the record button below the platform, and pressing again to stop the recording. The recording is stored digitally in the shelf itself and indexed with the exact weight of the object. Existing stories are played back by replacing the object on the weighing platform which returns the weight index. The system relies on all objects having a unique weight when measured accurately, but can be fooled by reproducing weights with a continuous pressure. Depending on how the shelf is calibrated, a story can be triggered from an object weight within some margin of error. This could become a playful feature of the system to allow users to scroll through a series of stories by applying increasing pressure to the platform. Alternatively, users could consider the relationship between stories for objects of a similar weight, or pile up multiple objects to elicit new stories, or record stories for objects which change weight. For example, flatmates could leave messages and replies for each other on a bar of chocolate they bite after listening to.

Figure 6. The memory shelf (pp13 and 14 in Fennell & Frohlich 2004 reprinted with permission)

Figure 7 shows an *anniversary plinth* which 'curates' any object placed upon it. Objects are identified by unique RFID tags, and come with a factual history that is written on the tag. This can include the date and place of manufacture and sale, service history, and owner information. In this way, the object can have its own memory of significant events over its lifetime. Unlike the memory shelf, the information associated with an object is not dispensed immediately, but is automatically generated on dates memorable to the object. For example the date the object was purchased or inherited could be printed on tickertape on its own anniversary. This would have the effect of advertising the memory of this event to its owner, and so overcoming the memory habituation which sets in with displayed objects. Not knowing when the plinth is going to spring into action might simulate the kind of serendipitous remembering that comes with a surprise rediscovery of a forgotten object.

Figure 7. The anniversary plinth (Figure 18 in Fennell 2005 reprinted with permission)

6. LESSONS FOR SIMPLE COMPUTING

The general purpose nature of computing technology means that it is always possible to add new functionality at minimal cost. In a competitive market place, this leads to featurism within digital products that try to out-do each other in technical rather than user value. The lesson of this chapter has been that user value is a different thing altogether, which relates to the activity being supported rather than the technology supporting it. By looking carefully at this activity and the value that could be added to it by technology, we can oppose featurism and complexity by prioritising and developing **only** functionality that really matters to people.

In the digital photography domain we have suggested that the core activity involves a kind of domestic iconography involving the use of tokens to manage memory, narrative and identity. This immediately highlighted the importance of tangible prints in photography and connected it with the use of memorabilia objects in the home. It also called into question a number of more-is-more assumptions underlying current

trends in the industry. These included the promotion of more realism in the photographic record, more ephemeral sharing of images on screens, and more coverage of life events through images. In each case, data from user studies helped us to test these assumptions and develop a more informed view of what users require. This usually led to an alternative approach which extended current practice in some new direction rather than replacing it with a new one. This was the case for instance in augmenting printed photographs with sounds (Figure 4) or capturing stories on displayed objects (Figure 6). These interventions allow consumers to continue using these familiar tokens as reminders, props and statements, but in new and more interesting ways. We see this approach as improving the 'fit' between technology, people and the cultural context in which they live, rather than offering up a new technology extension and hoping for the best. This property is the basis of what Landay, Bell & Saponas (2005) call *digital simplicity* - this volume.

In the end, the technology used to accomplish digital simplicity might well be more complex than that which leads to digital complexity for the user. We saw this in the discussion of multilayered audiophotos (Figure 3) which quickly become more technically complicated to represent than a linear video clip. This complexity might even extend to the user interface and user interactions with the product, as in the use of a second button for sound on an audiocamera (Figure 2). In some respects, this complicates the use of a traditional camera, but in a way which fits with and extends the practice of traditional photography. One could argue that it does this more simply than a camcorder, which although easier to operate, forces users to change practice and move to a secondary (screen-based) technology to playback the results. All this suggests that 'less' and 'more' are relative terms which can be viewed from two perspectives. From the users' point of view, they can get often get more out of less technology and less out of more technology, but sometimes it is possible to get more out of more technology. From the technology point of view, less and more are meaningless terms and better replaced with a notion of simplicity of use; meaning fitness for purpose and context.

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