

Opening up the Family Archive

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ABSTRACT

The Family Archive device is an interactive multi-touch tabletop technology with integrated capture facility for the archiving of sentimental artefacts and memorabilia. It was developed as a technology probe to help us open up current family archiving practices and to explore family archiving *in situ*. We detail the deployment and study of three of these devices in family homes and discuss how deploying a new, potentially disruptive, technology can foreground the social relations and organizing systems in domestic life. This in turn facilitates critical reflection on technology design.

Author Keywords

Home, domestic life, collaboration, archiving, interactive tabletops, field study.

ACM Classification Keywords

H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

General Terms

Design, Human Factors

INTRODUCTION

Domestic life is an area of sociality and collaboration of increasing interest to the CSCW community. Papers on home life frequently highlight the ways in which the home is different from work and how home technologies must therefore be designed with these differences in mind [27].

Much research in this area seeks to explicate the nature of family and domestic life, highlighting how households coordinate their day to day activities [10], how they revolve around routines [5] and how mundane artefacts are artfully appropriated [38], so as to sensitise designers of domestic technologies to these peculiarities of home life. Other research has explored how ‘ordinary’ and off-the-shelf technologies are ‘made at home’ or otherwise integrated into family life, revealing how the use and maintenance of things such as home networks reveal the nature of family life, roles within households and other such dynamic concerns [28, 15]. An alternative approach has been to

deploy, in the home, new kinds of technologies, often referred to as “probes” [e.g. 14]. Sometimes this is done for the purpose of bringing households into the design process [17], but at other times it can be done ‘provocatively’ [14]. Critics of this later approach [39] have commented that such research practices may be too alienating and disruptive, undermining the crucial development of, and understanding of, the domestication of technology.



This paper explores issues of family archiving: of the storage and management of items, both digital and physical, of a sentimental nature. It discusses the deployment of a technology probe we built, the ‘Family Archive’ (see Figure 1), designed to open up domestic archiving practices and inform our design process. In doing so, it enters the debate highlighted above. But here we adopt a middle ground: we show how deploying a new technology can indeed be disruptive, but in doing so we show how this is revealing of the social relations, organizing systems and process of ‘getting things done’ in domestic life. This, we would argue, not only helps in a deeper understanding of home life but allows us to reflect more critically on our technology and how it might fit into family life, supporting existing practices and creating emergent new ones.

Family Archiving

Family archiving and the ways in which households deal with and share memorabilia has long been a topic of interest more broadly within HCI, especially with regard to photos [6, 12, 19, 33]. More recently there has been further interest

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in how physical objects also acquire sentimental value in homes, which together with photos and videos, form a class of objects we might call mementos or memorabilia [30, 31, 13, 36]. The management, display, sharing and storage of these objects form a broad set of practices under the more general rubric of ‘family archiving’.

That the desire to store, organise and interact with such sentimental objects is a key human value is attested to in the many years of related anthropological and sociological research [4, 7, 9, 16, 23, 25, and 37]. This human value is slowly being considered in the designs of supportive digital technologies which aim to bring the benefits of the digital world to the physical in new archiving systems (e.g. living memory box [36], Memento [41] and Ubiquitous Memories [18]) and to some extent deliver the values of the physical to our interaction with the digital [26]. Speculation on the potential design of such future devices [11, 31, 36] often highlights the collaborative potential of these technologies for family use but most work in this space fails to see design ideas through to a deployable stage for *in situ* analysis. Our goal was to explore the design of such devices by conducting just such a deployment. And as many archiving technologies can be feature bloated, complex to use and possess a learning barrier [19] we were keen to develop a simple interactive interface.

Tabletops for Collaboration

As a research group we have extensive experience in the development of interactive tabletop systems. Consequently we were well aware of the debates concerning the potential for such systems to aid or hinder collaboration [21, 29, 35, 45]. Space precludes us however from a full discussion of this debate herein, but good reviews of the prior literature in the tabletop systems space can be found in [35] and [44]. Whatever the outcome of this debate, there was clearly potential for any archiving system which was built using interactive tabletop technology to have interesting implications for collaboration. Further to this, there are already a number of applications for archiving-related activities already built using interactive tabletops, typically for photo-sharing and story-telling applications [2, 3].

Beyond table technologies *per se*, there has also recently been an upsurge of interest in physics-enabled interfaces [1, 44]. Given our focus on the archiving of physical objects as well as digital, we were also keen to explore the potential of this class of user interface, particularly in the context of tabletops. Previous evidence [1] has also suggested that physics-led environments can lead to intuitively usable interfaces resonating well with our aim to build a family device, open to all.

In addition, the sociable and playful aspects of table interfaces have also further been highlighted in a growing number of studies which have sought to explore the deployment of interactive surface technologies in-the-wild [24, 32, 40, 42, 43]. Here we sought to add a long term home deployment to the corpus of emerging work.

Opening up the Design of the Archive

With these factors in mind, we wanted to design a deployable device which would be more inclusive than existing family archiving tools in two very different senses:

- First, we aimed to open up family archiving to the whole household by designing a device which would be intuitive to use, and which would be designed for collaborative, co-present interaction. In other words, we aimed to build a system which would foster collaborative practices around home archiving.
- Second, it would allow the capture and management of a more diverse range of memorabilia. This device would allow families to deal not just with digital materials such as photos, but also to capture digital images of physical objects that families might want to archive, such as a child’s first drawings, a letter from a relative that has passed away, souvenirs from family holidays and so forth.

A tabletop form factor and a physics-enabled interface coupled with a simple integrated means of performing object ‘scanning’ (capture) thus seemed like interesting ways of achieving these design goals which in turn would enable us to explore our over-arching research goals.

Goals of the Research

One goal of our research program in the family archiving space is to design and build a family archiving device, or set of devices, based on a deep understanding of current archiving practices in the home, and through a series of deployments in real households. In this paper we detail a first prototype, no doubt lacking in many essential features, which is a preliminary step along that road. Nonetheless, it involved complex design decisions, which have been expounded elsewhere [20].

In this paper, however, our focus is on family practices, and how a device which offers novel *and open* interaction possibilities can highlight, disrupt, change, or otherwise impact existing practices. As such, we report in depth on how the households that used our archiving device found its place in family life by exploring how existing archiving practices affected the ways in which it was used by different family members, and how ultimately it was perceived. We use our findings to more explicitly discuss the role of probes and technology deployments at home and the value they provide in foregrounding and explicating the social processes which drive, and are impacted by, technology interaction.

DESIGN AND DEVELOPMENT OF FAMILY ARCHIVE

The Family Archive device was a bespoke tabletop developed from the ground-up, using a combination of projection for display, with a size of 47cm x 35.5cm (18½” x 14”), and a camera and the well-established FTIR technique for touch sensing. Due to the throw distance of the projector and anticipated usages, the display was set at waist-level requiring people to stand rather than sit. We

were careful to set the surface height to support ease of use, without undue strain, when standing.

Our design incorporates a second high resolution stills camera above the display to capture and segment digitally the physical objects (either paper-based or 3D) placed directly on the surface (captured images are rectified). A physical button to the side of the display triggers capture. We were careful in the physical design to try and hide much of the technology from the user. Cameras, projectors and connected PC were all encased. A wooden top with extended space to the side and shelves allowed devices, ornaments and other objects to be kept by the archive (see Figure 1). A digital camera and dock was placed on one of these shelves to allow people to take and upload photos.

Photos uploaded by the digital camera or ‘scanned’ by the overhead camera are rendered (initially in piles) on the display and interacted with using multi-touch gestures. Objects are augmented with virtual physics using a technique described in [anon], allowing similar interactions to BumpTop [1] but scaling to model multi-touch input.

We use the metaphor of *virtual shoeboxes* (Figure 1, middle right) for containment, to loosely store collections of photos and scanned objects. An empty box is created using a ‘new box’ icon. Boxes can be moved and rotated, and box lids can be opened and closed using a two finger ‘pinch’ gesture. Once the lid is opened, boxes can be tipped to spill content. Items overlapping an open box are attracted into it, making it easier to quickly store multiple photos or scans. Boxes (and photos) can also be labelled with digital ink.

In order to contain clutter in the Archive, we decided to give the virtual space two “floors” which users can switch between – one floor where boxes are stored and another where photos are viewed and organised. The analogy we use is to have boxes stored in the basement, from where they can be moved up to the top level, and can be spilled out, loosely arranged, displayed and subsequently tidied up and moved down to the basement again. To give the user a sense of this two-storey arrangement and the ability to have an overview of the boxes stored in the archive, the ‘photo floor’ is slightly transparent.

One final set of features allows users to rapidly take a box from the basement, arrange the contained photos or scans in a grid, and begin a ‘slideshow’ to view individual items up-close and cycle through them sequentially.

FIELD TRIAL

To explore aspects of family archiving we built three similar devices, deploying each for one month *in situ* with a local family, visiting them regularly.

Research started with a pre-installation visit/interview in which we gathered information about the family and their current archiving practices (focusing on technologies used for archiving photos and videos and normal practices surrounding these) (this session was audio-recorded). Follow-on visits ensued (all video and audio recorded),

roughly one week apart for each family (routine maintenance on devices was performed at these times). On each visit we asked the family to recount their experiences of using the archive, to discuss their opinions of it and to literally show us the kinds of things they had been putting in the archive (this usually involved multiple family members closely interacting with the device to show us the content of their boxes). About half way through the field deployment, we also specifically asked each family to download some pictures, scan in some physical object and do some sorting as they had been doing, whilst in our presence, so that we could closely observe their practices. At the end of the deployment we returned to collect the Archive and conducted an exit interview to gather participants’ final reflections on the device and to ask them about how it had affected their regular archiving practices. (We also then collected system logs from the machines and log books of use from the participants).

Participants

Our three families were recruited by word of mouth and email advertisement and all came from the local area. We recruited families with the requirement that they did not have children under the age of 6 (as the back of the device was exposed and therefore possibly hazardous to small children), and that they had previous exposure to using digital photography. Participants were rewarded for participation by being able to keep the digital camera that was provided with the Archive.

Household A: consisted of a recently married French/German couple in their early 30’s. He was a biostatistician and she was an economist at a local university. Both travelled frequently for pleasure. Both had a post-graduate level of education.

Household B: consisted of an Argentinean married couple (in their late 30’s), with a 6 year old son. The father worked in medical research and the mother in technical development. Both had a post-graduate level of education.

Household C: consisted of a married couple (in their early 40’s) with two teenage daughters (aged 15 and 18). The father was Belgian-Irish and worked in software development and the mother was English and was a housewife. The father had a graduate level education, the mother, high school. This family had maternal grandparents staying for the first week of the trial.

Data analysis

Logged data of system use were collated and summarised after the field trial had ended. The video data of interviews and use of the system (which normally occurred at the same time) were then closely analysed by the research team. Transcriptions of interesting moments of interaction and reflection were transcribed and from this a thematic analysis was conducted.

FINDINGS

Over the course of the month, all three households chose to put their Archive in their living room. Two of the

households kept their systems running continuously (Households B and C) while Household A turned it on only when they intended to use it for uploading materials or displaying photos to friends, family and other guests. For them, the noise of the projector was the main issue which prompted them to turn it off.

Inevitably, as with most prototype systems, there were occasionally technical problems. Due to the fact that the system was vision-based, adverse lighting conditions caused problems both with the touch sensing and segmentation of scanned images. Because we rendered feedback in the UI when touch-points were sensed, households became very adept in detecting when rogue touch points were appearing on the surface, and devised workarounds like re-orienting light sources, and drawing curtains at times when the device was under direct sunlight.

Despite these problems, the Archive was used frequently during deployment, as summarised in Table 1. In addition, everyone in all three households used the Archive to a greater or lesser degree and it became a focal point for visiting friends and family.

| House | # days deployed | # days used | # photos uploaded | # scans created | # boxes filled |
|-------|-----------------|-------------|-------------------|-----------------|----------------|
| A | 27 | 13 | 312 | 29 | 21 |
| B | 30 | 21 | 765 | 84 | 30 |
| C | 32 | 18 | 429 | 136 | 25 |

Table 1: General usage statistics per household. (Note days deployed includes days when travelling and vacationing).

Existing Home Archiving Practices

In this section we describe some of the existing archiving practices in the families we observed prior to introduction of our device, and as a way of framing our findings once the device was in place. Here we highlight the types of technologies they were already using and the roles of different family members in that archiving process.

Family A, the young couple, owned one main capture device, a digital camera, which they shared but which was mainly used by the wife. She was principally responsible for photo capture for the family. Whilst both had mobile phones that could capture photos, they agreed that they rarely if ever used them in this way.

Existing practices saw the wife being responsible for photo management in the home. She uploaded and stored *all* pictures that they had taken to her Macbook and then filtered them (creating a subset) for sharing through the online Flickr service. Within the home, they had one other laptop computer (the husband's Linux machine) and a desktop computer too. Photo management remained though on the wife's Macbook (using iPhoto) and she had recently purchased Photoshop Elements so that she could do photo editing tasks. Digital data in the home was all backed-up automatically to a portable hard-drive (which had been

recently purchased after the wife's computer had died and they had lost significant amounts of data).

The husband appeared to be principally responsible for 'tech support' in the home and was clearly interested in the shared photo collection (approving the images that would end up on Flickr) but was rarely directly involved in managing the photos. The wife had many albums of print photos (now left at home in Germany with her parents) and she was the person most likely to ever print out digital photos, which, when it was done, was mostly for the purpose of sharing photos with relatives who didn't have computer or internet access. Having been recently married, the couple had many gifts and mementoes from their wedding, of a physical nature, which they were intending to keep and which they were keen to explore having digitised. Photos displayed in the home and any albums kept (few in number) were all curated and cared for by the wife.

Family B, the married couple and young son, also had one main capture device, a digital camera. The father in the family was the person responsible for taking photos and seemed largely responsible (though not always) for uploading and archiving photos on the family PC (and he seemed somewhat protective of these roles). Photo upload happened on an *ad hoc* basis and sometimes resulted in photos being left on other computers (parents' 'work' laptops) meaning the family archive of photos could at times be fragmented (or duplicated) over several machines.

Both parents had mobile phones but neither reported using them for photo capture. On the family PC, Picassa was used for viewing photos, although this was reportedly rarely done. Although the father was in charge of upload and organisation of photos on the family PC, it was the mother who principally engaged with them. She commonly edited them, tagged them and put together collections specifically to send to relatives (occasionally creating presentations in PowerPoint to facilitate a remote showing). She was also responsible for the creation and organization of any print photo albums that they had.

The mother also organised the physical memorabilia in the home, of which the family had a great deal, resulting in many boxes of sentimental artefacts in the garage. Many of these related or belonged to the son (broken toys etc). In the past, before they had a digital camera, they had tried scanning print photos so that they could send them to relatives overseas but had been unhappy with the quality of the results and the length of time it had taken to scan images, so this kind of practice had died out. The 6 year old son had used the family PC under modest supervision but had no real experience prior to the trial of using a digital camera or uploading photos to a PC. Those practices were largely restricted to the adults of the family.

Family C was the most prolific generator of digital content. They owned several digital cameras and all four members of the family (mother, father and the two teenage daughters) had mobile phones which they regularly used for photo

capture. All members of the family were regular photo-takers with the mother in particular being especially interested in cameras and photography. Both parents had their own laptop PCs (with a third spare which was commonly used by the rest of the family) and the eldest daughter had her own desktop PC. Photos were regularly uploaded to all of these devices but the father, who performed tech support for the family, routinely backed-up all digital photos (from all capture devices and computers) to a portable hard-drive and roughly every six months archived those photos to a DVD as an extra back-up measure. The father organised these photos in a year/event folder structure and would try to combine photos from different capture devices into this unified file structure.

Whilst the father was responsible for the technology in the home and backing up the photos, the mother was the person principally responsible for general organisation of the home. The family had lots of archived ephemera, some of which was stored throughout the house (ornamentation in particular) but older more specific items (such as boxes of baby toys and clothes) were carefully stored in the loft by the mother. Old print photos were kept by both parents which the father was slowly scanning. Photos displayed in the home were curated by the mother alongside other artefacts.

During the study period, the mother's parents were staying at the family home (Grandad and Grandma). They had extensive archives of old print photos and physical memorabilia. They had limited use of a laptop at their own home but were unenthusiastic about digital technologies in general. Recently, however, they had begun to use their mobile phones to take photos, but preferred to have images they captured printed out – which they did by sending the images from their phones to their son-in-law (the father of Family C) who then downloaded, printed and delivered the prints back to his parents-in-law.

Much sharing of photos in the home was via social networking sites online and physically on mobile phones. All family members engaged in this process.

Opening up the Family Archive

We now turn to examine what happened when the Archive device was introduced into these homes. As we have seen, these were three very different households in terms of their archiving practices. Dealing with photos in Family A was mainly the domain of the wife who was in charge of the whole photo “life cycle” from capture to upload to organisation and sharing, with the husband mainly acting in a tech support role. As a result the collection tended to be quite integrated and coherent. In Family B, the roles were shared with the father doing most of the early activities such as capture, upload and initial organisation, and the mother taking on the role of editor, and preparing photos for sharing via electronic or print means. The archive here was more distributed over machines. Third and most distributed was Family C with all four members of the

household capturing photos and storing on various devices. The father in this family acted to try to collate and back-up the various disparate collections, including helping with photos from his parents-in-law. What we do see in all three households are many clearly defined roles for different family members. For example, we saw the wife/mother in each household mainly in charge of general household organisation, curation of photos in the home, and to some extent sharing. This finding resonates with previous work characterising women's dominant role in housework [22, 34]. What is interesting here, though, is how the use of technology in archiving also draws in the men not only in their role as “tech support” but also for jobs which blur the boundaries between housework and technology, such as doing back-up of photos.

What happens then when a device enters the home that disrupts these firmly entrenched practices? Specifically, what is the impact of a device designed to encourage new and emerging practices by opening up these practices to new kinds of content, new activities, and new roles in the household? It is these issues we examine next.

Opening up to Collaboration?

One of the important benefits put forward for multi-touch surfaces is that more than one person can use them at the same time. “Collaborative use” in this sense means synchronous, co-present and multi-person use. Indeed, the benefits of many interactive tabletop systems are often characterised this way.

In fact, the data from this study shows little in the way of synchronous collaboration. From our interviews and our observations of practice, it became apparent that users only ever used the Archive together under highly specific circumstances. The principal reason for shared co-present use was for the viewing of photos in a presentation-like mode wherein one user would show photos to another. And under these circumstances, either the automatic slide-show feature of the device was used to control the presentation or the person narrating manually directed the flow of the images as they presented them, the other person typically acted as a passive audience, not interacting with the images. More typical use of the system was solitary, where one user would upload, scan and work with photos or scanned images, or would just idly viewing pre-existing images for their own pleasure. This underlines the fact that the use of the Archive was seldom “collaborative” in the narrow sense of the term outlined above.

Now it could be argued that there were physical constraints such as screen size and height which prevented this kind of collaborative use. Equally, there were constraints inherent in design of the UI which may have undermined synchronous use. For example, there were modal interactions such that if one user wanted to ink on objects another couldn't simultaneously move objects, or if one user wanted to retrieve an object from the basement, this would shift the view for other users.

While these issues would undoubtedly constrain the nature of collaboration in the moment, it was also evident that people were commonly turn-taking or using other means of social negotiation to work together if the reasons for doing so were compelling. While the design of the device itself may have undermined synchronous collaboration to some extent, it appeared more fundamentally that the nature of family archiving in the home was just far less synchronous than we might have assumed. We return to this issue later.

Opening up to New Content

One of the principal features of the Family Archive device was its ability to ‘scan’ physical objects. This meant that any physical object (within limits) could be placed onto the interactive surface and then be captured by a camera above. This enabled families to easily scan objects, such as children’s artwork, ticket stubs or ornaments, or basically anything they could fit on top of the device. While the scanning was easy (requiring a single button press), it was also time consuming, taking about a minute to do the image processing, segmenting and rendering.

By the end of the trial period each family had engaged in a variety of scanning practices and had committed to their archive a variety of different objects.

Family A had gone into the trial intending to scan a variety of objects (mostly 2-dimensional) associated with their recent wedding. In particular they were keen to try and scan some confectionary wrappers on which guests at the wedding had been encouraged to leave congratulatory messages for the couple. The wife of the family had over a hundred of these wrappers which were being slowly revealed as the couple ate their way through the sweets. Her initial attempts to scan the wrappers had proved frustrating however as she was not getting the results she wanted.

“If it had been perfect we would have done the wrapping papers more but I think with the white background it just didn’t work out that well.” – Wife Family A

Despite thinking that the white, papery objects needed much more stringent quality control, she was impressed by the ability to scan more colourful and three-dimensional objects. In particular she mentioned that it was potentially amusing to be able to incorporate what she felt were incongruous objects, such as fruit and vegetables, into a slide show of pictures that she could show people.

“We mixed some boxes for slideshows, we tried to mix pictures with scans – we thought it would be funny to have the tomatoes in between.” – Wife Family A

For her, there was real value in opening up one’s archive to include more novel content along with standard images to provide a richer collection. They had certainly been extremely keen to include their sweet wrappers and seemed disappointed that the results had not met their initial expectations. But this didn’t deny for the wife her interest in the principle of including more diverse objects in edited collections of memorabilia. For the husband there was little

interest in scanning, but this was consistent with his existing and somewhat peripheral role in the archiving of mementoes and creation of content anyway. For this family, then, existing roles in terms of archiving were played out and highlighted through the device, rather than being disruptive of them.

Family B was a different story, however. Here there was much more extensive use of scanning, particularly by the family’s young son, aged 6, who eagerly adopted the archiving device and especially the scanning feature. The simplicity of capture and the ability to capture any physical object (within reason) meant that he could integrate into the archive his own content independently of his parents, something he hadn’t been able to do before. Other factors contributed too: it was kept in a shared space, it was always-on, and it was available to be used for long periods of time after school whilst his parents were still at work.

In this vein, over several visits we observed the son producing vast numbers of scans of his own toys, including his entire (and quite large) collection of plastic dinosaurs and action figures. In part this frustrated his parents whose efforts to maintain some semblance of organisation in the archive were thwarted. It was not unusual for the parents to open up a box of their carefully sorted photos only to find a dinosaur or two mingled into the collection.

Here, then, we see a tension between what might normally be seen as the parents’ aspirations to organise, manage and keep tidy these archived materials, and their son’s subversive use of the system. By designing an archive capable of easily capturing any physical object, the normal roles and routines with regard to archiving had been significantly disrupted.

In Family C, and in keeping with this family’s general embracing of technology (excluding the grandparents), scanning occurred with all members of the family somewhat equally. The mother in particular was an early adopter. Intriguingly, whereas she in the past she had left large scanning tasks to her husband (such as scanning their backlog of printed photos), she was becoming actively involved in the creation of objects for the archive. She also began to formulate plans for sets of things that she would like to scan. There was a suggestion of cataloguing all of the books and DVDs that the family owned and efforts were made to begin this process. The Grandad of the family was also seen to try the scanning process. Despite being avowedly “anti-technology”, the family was keen to inform us that he regularly used the device.

“For somebody who found lots of niggles with it he hasn’t left it alone [...] that’s a compliment in itself.” – Mother Family C

In particular on one visit the family proudly showed us some old print photos that Grandad had been scanning into the device of himself and his wife. But at the same time the family was keen to repeatedly berate the grandad for a

reported misuse of the system in which he'd managed to accidentally delete some scanned pictures of which the rest of the family had been particularly fond. They were making it clear to the grandad that he shouldn't use the device unsupervised (and we noticed this during interactions in our presence when he would indirectly ask his daughter for permission to hit some buttons on the interface). The open nature of the interface evidently lent itself to him actively exploring the creation of content and to getting involved but this then also raised a tension over who had the right or perhaps the competence to use the device, lest the 'family' archive be disrupted.

Opening up to Play

Previous research has largely characterized domestic photo activities as various forms of work [19] and typically more broadly "domestic work" [22]. But what of the Family Archive? Here we see a real tension between some family members' notions of archiving as work, and the design of the archive encouraging instead, playful interactions with these same materials.

This was most evident again for the son of Family B. For him, using the device was not really about archiving in the sense that we outlined early in this paper. For him the scanned objects were for play, and not for recollecting events, preserving the past, sharing with others and so on. After scanning in his toys, he would regularly engage in long play sessions, moving around and resizing his characters, and narrating a storyline. In this way, scanned images of objects were viewed very differently from more canonical digital archive content such as photos.

However, one side effect of using the Archive as a playground was that it supported the parents' notions that this device was therefore not a place for doing any serious work with photos or other materials. In particular, the fact that anything that the parents carefully organised become quickly disorganised brought them to the point where they requested separate "compartments" for themselves and their child to protect them from what they viewed as the chaos caused by these play activities.

By opening participation to those normally excluded however, such as children, more playful interactions were perhaps inevitable. However, playfulness with the Archive was not limited to young children. For Family C, many of the interactions were also playful in nature. That family in particular had new kittens and so whilst there was much regular photographing of the kittens occurring there were also many attempts made to 'scan' the kittens into the archive by running them across the top of the surface whilst using the integrated capture device. There were also lots of scanned images of body parts hidden in boxes where members of the family had positioned themselves under the integrated camera. This was clearly not done to form some kind of record, but was a playful exploration of the technology. Evidently the rapid scanning and upload of images to the device was creating potential for ephemeral

and lightweight digital interactions which otherwise would not have occurred. This inherently made the device playful.

Aside from opening up the Archive to children, and the ability to scan, the other fundamental aspect of Family Archive that encouraged play was the design of the UI. The very nature of the physics based interactions that had been developed for the system lent it a curious quality that resulted in people being drawn to play with it. Instilling in objects the ability to respond to forces when touched such that they could be flicked across the screen, gathered up, piled, knocked over, placed into boxes and then be poured out meant that people became very 'hands-on' with their data. For some it was this purely hands-on interaction that got them interacting with their digital content when they really wouldn't otherwise.

"I would say that Vince certainly likes the technical side very much; he's very fascinated by the interface, by the physics and stuff, so it might make him more interested than having them on a laptop." – Wife Family A

But the fact was that the physical work to manage and manipulate the contents of the Archive (including tipping over boxes, labelling them etc) was seen as undermining the need to efficiently get work done. After all, physical gestures, tumbling boxes and so on are fun and compelling, but they are effortful and time-consuming ways of interacting too. Our participants' accounts of use were replete with comments like:

"I find it really cool but sometimes I find it really annoying that when you've got a box that is extremely full you try to tip it and ¾'s of the content comes out but not the rest and then you have to try to shake it." – Mother, Family B

Opening up to the Non-technical

All of this leads on to our final related set of observations which have to do with the ways in which the design of the Archive created some ambiguity about what the device was "for". In particular, many of our participants were seen to wonder whether the device was intended to be "like a PC" or not. In fact, as we stated at the outset of this paper, in designing the Archive, we wanted to create a system which would be both intuitive to use and accessible to all. In doing so, and because we had built the system from the ground-up, our feature set was in fact quite small compared to software tools on a PC. Similarly, the Archive was lacking in the important connectivity that a PC has in terms of linking to web content, being able to print, and being able to send content to others. So, the Archive was a computer, but was not *really* a computer. In opening up its design to intuitive, accessible use, we had caused other kinds of complications.

For example, it was clear that in focusing on input into the device (such as photos and scanning) we had paid scant attention to editing or modifying that content, as one might on a PC. The ability to perform fine-grained manipulation of images such as cropping, red-eye correcting and colour

balancing was one such request. The fact that one couldn't do this also reinforced that the Archive was not really for doing serious "work" with photos. Equally, our users requested the ability to move content between the archive and external sources such as the web, digital photo-frames or printers. This highlighted a significant desire for the device to be richly connected to other devices associated with regular photowork practices.

This then raised for us the question of how PC-like our device should be. Our families asked that we install functionality in the family archive highly similar to that already present in the home PC. But it was evident that this could work against some of the valuable qualities that the probe already delivered. For example, we had received positive feedback from our families precisely because of the device's lack of PC-like attributes.

"I have watched a lot more of my pictures, having this thing, a lot more than with having a computer [...] If I have to go to the computer to look at my pictures I will look at the pictures and I will probably do something related to work whilst I'm at it, so I'll check my email or I'll do something about work and I don't wanna do that I just wanna look at pictures." – Mother Family B

Further, adding more features and functionality to the Archive would inevitably complicate the interface, possibly altering its accessibility to those who might be drawn in, or alienating those with a natural aversion to technology.

Alongside the issue of feature set and connectivity, it was also evident that the interface style with its hands-on approach combined with the always-on nature and the careful siting of the device (within the home itself) were other significant aspects that made it "un-PC-like". And again, in doing so, these aspects too subverted the status quo when it came to who did what in archiving.

In Family A, where the wife traditionally performed most of the photo organising and sharing activities, we had delivered the means by which the husband might be more inclined to interact with the content and to author presentations of it. Likewise in Family C, whereas the father was traditionally responsible for all back-up and scanning activities, we had delivered the potential for other members of the family to begin adding and integrating content into a shared repository. For Family B we had delivered a tool that directly allowed the family's young son to begin to get involved in shared practices of family photography, and we had found new ways for him to express himself through digital means, giving him access to shared family content in a way that he had not had before.

Such changes in practice are not just about new opportunities. They can also be fraught with problems. In particular, and as we have already alluded to with Family B, where the father had traditionally been very in charge of organising the archive, there was perhaps some resistance to this loss of role. Equally, where he had managed and

organised, being responsible for technology in the home, the wife also now felt compelled to 'clean' the archive and keep it tidy, this desire prompted perhaps by the digital content now being always visible and in a shared family/public space where outsiders might see the archive.

"Whenever it was messy, yes it was like, oh my god, not only have I got to clean up my house on a Saturday but now I have to clean up the flippin desktop." – Mother Family B

Suddenly the device had crossed a boundary and become somehow a part of her domestic routine rather than just her husband's. So the subversion of roles and interruption of common practices that was taking place highlights some potential benefits of these forms of technology but also foregrounds issues which might limit their adoption.

DISCUSSION

We started this project by building a device which we hoped would open up the processes of family archiving in the sense of making new things possible and drawing in more of the family. We believed the technology might lead to new practices being formed or new creative landscapes being envisioned. While these things did happen, this project opened up archiving in another way too: it opened up our understanding of archiving practices and family life. Our results highlighted, as other papers have suggested [5, 15, 27], how new technologies must necessarily find their place within the complex ecosystem of the home. In essence, by deploying these systems into real homes against a complex backdrop of ingrained social relations and organizational processes, the disruption and tensions (as well as the delight in the new opportunities the technology provided), afforded us a way of understanding archiving as it is normally played out in family life. Further, it helped us reflect on aspects of the design of such systems that would influence how they would be perceived and used.

One set of issues had to do with rights, roles and responsibilities within the home. Younger members of a family have an identifiable right to 'play' with devices, if they are allowed to use them at all. Fathers are often seen as (or more correctly set themselves up as) the people who 'take control' of technical objects in the home, and mothers tend to take on the responsibility for anything that appears to be domestic work, including the curation and sharing of memorabilia in the home. This is in line with other research which has shown that keeping hearth and home together is often viewed as "mothers' work" [22, 34]. As we saw, Family Archive acted to disrupt these roles, but in doing so, threw these issues into sharp relief in the course of our interviews and observations.

Another set of issues had to do with the nature of collaboration. What we originally saw as a design for "in the moment sharing" was actually rarely used synchronously by people together. This in turn points to what collaboration in a home context more accurately means. A shared device for the home might be one that is truly used together "in the moment", but as important, it can

be used by different members of the household at different times and for different reasons. Further, these activities can sometimes be coordinated and cooperative, say building on each other's work to manage the content of the archive, but equally, they can be conflicting and disruptive of any one individual's activities. This has implications for how one might design technology and conceptualise interface requirements for interaction for "family" devices.

Finally, how people perceived the device was intimately linked to such issues. Being supportive of 'photowork' tasks and active management of an archive suggested a tool of work, but playful interactions and the ability to create new forms of content, along with our suggested placing in the home subverted this. Furthermore, the lack of important features also created ambiguity for users. Was it a PC? If it was, then this suggested use by the family technical experts, but if it was more of an entertainment device, then maybe anybody could and should use it: children, grandparents, and even visitors. Further, if the device was in a public space and was seen to create messiness [8], then it becomes the responsibility of the person who normally does the domestic work in the home. Such issues are therefore impacted by many aspects of design, including where a device is designed to be placed, the style of interaction, the activities it enables, and the features it offers.

IMPLICATIONS FOR DESIGN

Opening up the family archive has led us to reflect on many design issues, both more generally and also quite specific. A family device, as we have seen, can mean a device which all household members have access to, which all can use, and which supports a wide range of different activities. All of this might be taken to bode well for collaboration and for inclusivity, or these aspects of the design can, as we have seen, also set up tensions and disruptions over how the technology should be used. If we were only to focus on how to enhance collaboration in the sense of bringing people together to engage in shared activities, we might concentrate on features to facilitate synchronous collaboration like height of the device, size of the screen and minimizing modes in the design of the UI. But thinking about what collaboration means more broadly in family life, how it is often about different roles and expertise for example, would lead us to other conclusions as well. It guides us to consider aspects of the design to help support the coordination of different activities across time, to help deal with conflict by perhaps partitioning out areas of the shared device for use by different people, and to support the range of activities people might want and expect in a device truly designed for the whole family.

Other implications have to do with how the design of the device impacts people's perception of it, and this in turn is both based on, and determines usage. Here we saw tensions and ambiguity over whether this was a device for work or for play, and about whether this was a PC, or not a PC. The first dichotomy suggests the need for provision of clear distinctions within the system of when one is playfully

interacting and when one is intending to do serious 'work'. It suggests not only that one might be able to switch from a playful mode to a work mode, but also that products of organization must be safeguarded against the chaos of play. That being said, the chaos of play should not be shied away from as we saw it allowing creative engagement with archived content. This suggests the zoning of activity, the ability to "rewind" it, and to do rapid 'cleaning'.

With regard to the second dichotomy, our findings also clearly demonstrated that if an archiving device is to be used in a more content management role then it must conform to the existing practices of (for want of a better term) 'photowork'. In other words, it must provide much more of the important functionality of a PC, even if its interface, form factor and interaction style is quite different. This suggests such things as the provision of rich connections between the device and other sites of action in the home or beyond. Web integration and the ability to pass data to other display devices or machines (such as printers and digital photo displays) also appear to be crucial. As such, a family archiving device, rather than being a singular entity, must be something that sits at the centre of a seamless ecology of devices and interactions within the home and reaching out to a wider community too.

CONCLUSION

In conclusion and returning to the original debate, we suggest, disruptive technologies can illuminate family practices by the very fact that they perturb "what is normal". Though others [39] argue that such deployments fail to account for ways in which a technology is disruptive of ordinary practice and the process of domestication, we would argue that it has other benefits. We believe such deployments point to new directions for design precisely because they help us reach a better understanding of socio-behavioural practices. These in turn, as we have shown with family archiving, can sensitise us to aspects of design that impact everything from perceptions of a technology, to use in interaction, through to its role within a family household.

REFERENCES

1. Agarawala, A. & Balakrishnan, R. (2006). Keepin' it real: pushing the desktop metaphor with physics, piles and the pen. *Proc. of CHI, ACM*, 1283 - 1292
2. Apted, T., Kay, J., & Quigley, A. (2006). Tabletop sharing of digital photographs for the elderly. *Proc. of CHI, ACM*, 781 - 790.
3. Balabanović, M., Chu, L. L. & Wolff, G. J. (2000). Storytelling with Digital Photographs. *Proc. of CHI*, 564-571.
4. Chalfen, R. (1987). *Snapshot Versions of Life*. Bowling Green State University, Popular Press.
5. Crabtree, A. & Rodden, T. (2004). Domestic routines and design for the home. *Proc. Of CSCW*, 13, 2, 191-220.
6. Crabtree, A., Rodden, T., Mariani, J., (2004) Collaborating around collections: informing the continued development of photoware. *Proc. of CSCW* 396 - 405.

7. Csikszentmihalyi, M., Rochberg-Halton, E. (1981). *The meaning of things: Domestic symbols and the self*. Cambridge University Press.
8. Douglas, M. (1966). *Purity and Danger*. Routledge.
9. Douglas, M. & Isherwood, B. (1979). *The World of Goods. Towards and anthropology of consumption*. Routledge.
10. Elliot, K., Neustaedter, C., & Greenberg, S. (2005). Time, Ownership and Awareness: The Value of Contextual Locations in the Home. *Proc. Ubicomp* 251-268.
11. Frohlich, D.M. & Fennell, J. (2007). Sound, paper and memorabilia: Resources for a simpler digital photography. *Personal and Ubiquitous Computing* 11 (2): 107-116.
12. Frohlich, D.M., Kuchinsky, A., et al. (2002). Requirements for photoware, *Proc. of CSCW*, 166 – 175.
13. Frohlich D.M. & Murphy, R. (2000). The Memory Box. *Personal Technology* 4: 238-240.
14. Gaver, W., Sengers, P., Kerridge, T., Kaye, J., & Bowers, J. (2007). Enhancing ubiquitous computing with user interpretation: field testing the home health horoscope. *Proc. of CHI*, ACM, 537-546.
15. Grinter, R. E., Edwards, W. K., Newman, M. W., and Ducheneaut, N. (2005). The work to make a home network work. *Proc. of ECSCW*, Springer-Verlag, 469-488.
16. Hoskins, J. (1998). *Biographical Objects: How Things Tell the Stories of People's Lives*. Routledge.
17. Hutchinson, H., et al. (2003). Technology probes: inspiring design for and with families. *Proc. CHI*, ACM, 17-24.
18. Kawamura, T., Fukuhara, T., Takeda, H., Kono, Y. & Kidode, M. (2007). Ubiquitous Memories: a memory externalization system using physical objects. *Personal and Ubiquitous Computing*. 11, 287-298.
19. Kirk, D. S., Sellen, A., Rother, C. & Wood, K. (2006). Understanding Photowork. *Proc. CHI*, ACM, 761-770.
20. Kirk, D. S. et al., (2009). Putting the Physical into the Digital: Issues in Designing Hybrid Interactive Surfaces. *Proc. of British-HCI*. BCS, 35-44
21. Marshall, P, et al (2009). Fighting for control: children's embodied interactions when using physical and digital representations. *Proc. CHI*, 2149-2152.
22. Martin, B. (1984). Mother Wouldn't Like It!': Housework as Magic, *Theory, Culture & Society*, 2, 2 19-35.
23. Mauss, M. (1954). *The Gift*. Routledge Classics.
24. Mazalek, A., Reynolds, M., Davenport, G. (2007). The TVViews Table in the Home, In *Proc. IEEE International Workshop on Horizontal Interactive Human-Computer Systems*.
25. Miller, D. (2001). (Ed.) *Home Possessions. Material Culture Behind Closed Doors*. Berg.
26. Nunes, M., Greenberg, S. & Neustaedter, C. (2008). Using Physical Memorabilia as Opportunities to Move into Collocated Digital Photo Sharing. *Research report 2008-919-32*, University of Calgary, Canada.
27. O'Brien, J. & Rodden, T. (1997). Interactive systems in domestic environments. *Proc. DIS '97*, ACM, 247-259.
28. O'Brien, J., Rodden, T., Rouncefield, M., & Hughes, J. (1999). At home with technology: an ethnographic study of a set-top-box trial. *ACM Transactions on Computer-Human Interaction (TOCHI)*, 6, 3 282-308
29. Peltonen, P., et al (2008). It's Mine, Don't Touch!: interactions at a large multi-touch display in a city centre. *Proc. of CHI*. ACM, 1285-1294.
30. Petrelli, D., van den Hoven, E., & Whittaker, S. (2009). Making history: intentional capture of future memories. *Proc. of CHI*, ACM, 1723-1732.
31. Petrelli, D., Whittaker, S. & Brockmeier, J. (2008). Autotopography: What Can Physical Mementos Tell us about Digital Memories. *Proc. of CHI*. ACM, 53-62.
32. Piper, AM & Hollan, J. D. (2009). Tabletop displays for small group study: affordances of paper and digital materials. *Proc. of CHI*. ACM, 1227-1236.
33. Rodden, K. & Wood, K. R. (2003). How do people manage their digital photographs? *Proc. of CHI*, ACM, 409-416.
34. Schwartz Cohen, R. (1985) *More Work for Mother*. Basic Books
35. Scott, S. D., Grant, K. D., & Mandryk, R. L. (2003). System guidelines for co-located, collaborative work on a tabletop display. *Proc. of ECSCW*. 159-178.
36. Stevens, M. M., Abowd, G. D., Truong, K. N. & Vollmer, F. Getting into the Living Memory Box: Family archives and holistic design. *Personal and Ubiquitous Computing*, 7, (2003), 210-216.
37. Stevens, M. M., Roberts, J., Bandlow, A. & Newstetter, W. (2001). *Capturing Memories: An investigation of how parents record and archive items about their child*. Georgia Tech Rep.
38. Taylor, A. S. & Swan, L. (2005). Artful systems in the home. *Proc. of CHI*. ACM, 641-650.
39. Tolmie, P. & Crabtree, A. (2008). Deploying research technology in the home. *Proc. of CSCW*, 639-648.
40. Van de Mortel, D. & Ju, H., (2007). Apartgame: a multi-user tabletop game platform for intensive public use. *Proc. of IUI conference*, 49-52.
41. West, D., Quigley, A. & Kay, J. (2007). MEMENTO: a digital-physical scrapbook for memory sharing. *Personal and Ubiquitous Computing*. 11, 313-328.
42. Wigdor, D. et al (2007). Living with a Tabletop: Analysis and Observations of Long Term Office Use of a Multi-Touch Table. In *Proc. IEEE International Workshop on Horizontal Interactive Human-Computer Systems*.
43. Wigdor, D. et al (2009). WeSpace: the design development and deployment of a walk-up and share multi-surface visual collaboration system. *Proc. CHI*, 1237-1246.
44. Wilson, A.D. et al (2008) Bringing Physics to the Surface. *Proc. of UIST*. ACM, 67-76.
45. Zhang, X. & Takatsuka, M. (2007). Put That There NOW: Group Dynamics of Tabletop Interaction under Time Pressure. *Proc. IEEE International Workshop on Horizontal Interactive Human-Computer Systems*. 37-43.