AutoTopography: What Can Physical Mementos Tell us about Digital Memories?

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ABSTRACT
Current technology makes it possible to capture huge amounts of information related to everyday experiences. Despite this, we know little about the processes by which people identify and manage *mementos* - objects which are directly meaningful to their memories. Among the millions of objects people encounter in a lifetime, few become such reminders of people, places or events. We report fieldwork where participants gave us a tour of their homes describing how and why particular objects become mementos. Our findings extend the existing digital memory literature; first our participants didn't view their activities as experiential 'capture', nor were mementos limited to pictorial representations of people and events; instead they included everyday objects. Furthermore, mementos were not only displayed and shared, but also integrated into everyday activities. Finally there were complex relations between house location and memento type. We discuss the theoretical and technical implications of our work.

Author Keywords
Fieldwork, autobiographical memory, digital mementos.

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

INTRODUCTION

Memories are crucial to self-identity and everyday functioning, yet memory is known to be fragile. Much research is currently being done into 'lifelogging'. Examples include recording every conversation, computer interaction and piece of encountered information [1], audiovisual logging of personal experiences [19, 22]. This approach is motivated by the view that memory is an *archive*, with a consequent emphasis on capture. By emphasizing capture, however, it fails to address people's motivations for remembering past experiences and what they value as mnemonic representations of their lives. While other research [7, 12, 10, 17, 23] has begun to document how different memory technologies are used by people, the dominant approach still emphasizes capture.

Instead of focusing on the technology involved in complete capture of one's entire life, this paper therefore reports a fieldwork study to understand the principles behind *mementos*. A memento is an object given or deliberately kept as a reminder of a person, place or event.

"*the shells are quite important because they are memories of our family holidays*"

Figure 1

A better understanding of what makes a memento, as well as how, when, and why mementos are chosen should help the design of technology for recording, storing and accessing digital memory. We are interested in documenting how people use such objects to construct a sense of themselves by cultivating their physical environment – behaviors referred to as *autotopography* [14]. An autotopography is an arrangement of those objects that constitute "a physical map of memory, history and belief." Our research therefore shifts the focus away from capture technology to ask how people choose significant memory objects and how they arrange and use those objects in their living space. We address the following questions:

- What *types* of objects are mementos? Are mementos predominantly photos and artwork, or do other types of object serve this function?
- *How* and *why* do certain objects serve as mementos? Do they represent an event in the owner's life, do they signal social relations with others, or are there other reasons?

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- *When* in a person's life are mementos drawn from? Do they relate to the distant past, or throughout the lifespan?
- *Where* are mementos kept, and does location relate to their type? For example, are personal mementos kept in private spaces and social mementos in public locations?
- *Invocation:* How do people interact with mementos? Are they used as talking points with others, or are they placed in personal spaces to facilitate more private reflection?

The study involves parents of young children touring their house and discussing objects related to their own past. We identify key principles that underlie objects becoming mementos. We discuss the implications of our findings, concluding with new design principles and concepts for digital memory technologies.

RELATED WORK

Our research intersects autobiographical memories, personal and family interaction, material culture and technology. So far, prior research has focused on each of the above separately and from a specific point of view.

Research on memory has been carried out mainly in psychology. Recent work challenges the traditional view of memory as a knowledge base [6], instead proposing a core role for recollection and social dynamics [4, 10, 21, 27].

Sociological studies of personal and family interaction have focused on the role of objects [8] or photographs [5]. When technology is included the focus is on family communication [9, 16] or photo sharing [7, 12].

Philosophers have theorized about the relation between the self and the home as lived experience of the space [2] and on the act of remembering as a constant shifting between the abstract mind and the physical world [3].

Some anthropological studies have examined material culture and the life of individuals. The process of commoditization changes the perceived value of objects depending on the culture [20]. Everyday objects can become biographical [15] or evocative [25] by virtue of the meaning imputed to them by the owner, e.g. as significant personal possession [15], or symbols of experiences [25].

HCI research has addressed helping people remember factual information (e.g. [17, 18, 23]), with rather fewer studies of the role of memories in people's emotional life and the implications for technology design. The Memory Box [11] used a jewelry box metaphor to associate a recorded narrative with a souvenir. It appealed more to women and children: children used it as a personal journal, while adults perceived the value of attaching narratives to objects only if they were given/received as gifts – but not for personal use. The work identified a clear need for a self-contained, simple technology for recording and playback.

The Living Memory Box [13] supported the collection, archiving and annotation of family memories. An ethnographic study investigated the "who, what, where, when and why of [parents] saving memories of their child's life". Parents collected some mementos for children but never recorded stories related to those objects. The resulting system allowed users to place a physical object in the Living Memory Box, record its appearance, an audio narrative and metadata to support later retrieval. The concept was tested with scrap-bookers. The results show that personal archival systems must be designed differently from PCs, supporting natural interaction (e.g. touch, voice).

Souvenirs, personal memory, and recollection were investigated in [26]. Participants discussed souvenirs they had brought to a focus group meeting. Analysis of discussions suggested that souvenirs are esoteric: they carry meaning for their owner but this is obscure to others. Furthermore, the telling of the story behind the object changed depending on the relation between owner and audience. A questionnaire on the perceived value of souvenirs and their function in people's lives revealed: souvenirs relate to memories of a personal experience (holiday, honeymoon) or a specific person (heirloom, gift), and are "used" (watched, talked about). Informed by these studies the author designed a system that used RFID-tagged physical objects to retrieve a set of images previously associated with the object. A hand-held device (a tablet PC) allowed users to view images, share a subset on a TV, manage collections, or send selected ones via email or print.

METHODOLOGY

Our fieldwork study aimed to understand the principles of how and why an object becomes a memento. The home was chosen as the place to study, as it is a space created and cultivated as a "container" of the owners' intimate self, beliefs and aspirations. The family home in particular contains personal and shared objects, the most valued often being related to memories [8]. The family home is a richer place to study than other inhabited public spaces, e.g. work places, as participants have more control over how that space is constituted and configured. We focused on families with young children as being active collectors of mementos. Parents have memories of their own lives before meeting their spouse; shared memories as a couple; and are generally highly active as curators of their children's 'future' memories.

We recruited a middle class sample on the basis of [8]'s finding that they are oriented to memories and relationships in contrast to other social groups that focus more on possessions. Participants were recruited by acquaintance and covered a range of professions (doctor, museum conservationist, high-level managers, architect, training consultant, publisher, marketing manager), a housewife (with a degree in psychology) and a few academics.

In contrast to much previous research that used interviews or focus groups for data collection, our participants had a highly active role. We gave them this orienting information: *'We would like you to take us on a tour of your house. We want to see rooms that you consider public, family rooms,*

and your own. In each room we would like you to pick 3 objects related to your life and tell us why each object is special, when and how you got it, why it is in this room and if you ever reflect on it or talk about it.'

For each participant, we collected at least 9 objects and their associated explanations and stories. By contrasting three different room types we wanted to probe the relations between the public/private nature of the space and the type and intimacy of the mementos in that space, e.g. a public room used for entertaining, might display an artwork received as gift, while the study might hold personally significant pieces, e.g. photographs of holidays.

This "memory tour" allowed us to collect both autobiographical narratives as well as observations about object location and any accompanying emotions displayed by the informant, e.g. the way an object was caressed or held. While there were specific topics we intended participants to discuss, e.g. what memory the object evoked and why it was important, we let participants talk freely and prompted only those topics that were not spontaneously mentioned. The overall tone was informal and friendly, and a small gift was given as token of gratitude for participation. Questions about the participant's attitude towards keeping objects concluded this memento tour. As we shall see, only one participant made reference to *digital* mementos during the tour, so we later explicitly probed attitudes to digital mementos. Participants were also asked to draw/sketch their autobiography. For reasons of space, we constrain our main analysis to the initial house tour and the objects people selected in it.

DATA COLLECTION AND ANALYSIS

In total, 16 people (from 12 families) participated in the study, 6 men and 10 women; 5 were living in a country different from the one they were born in. When both adult family members participated, the tour was done individually. Each session lasted 90-120 mins. and was tape recorded. Pictures captured the memento and its context. In total, 159 objects and their related stories were collected.

We were concerned that the affordance of the rooms and the request to select 3 objects might bias interviewees. However, participants often discussed more than the nine stipulated objects if more important ones came to mind at a later stage. Moreover some participants in the first room of the tour foreshadowed important mementos they would discuss in later rooms, showing they have a clear idea of which memories and mementos are important. Follow-up questions and comments also supported the view that we were able to collect stories about people's most critical autobiographical memories.

We transcribed all the interview tours, and systematically classified relevant portions of text. The topics of interest were used to start a broad classification, e.g. type of object, location, value, time (in the person's life), while other dimensions and refinements emerged from analysis of the narratives, e.g. reference to specific periods in the owner's life or emotional involvement. We first generated a wide set of terms that were later aggregated and distilled into a smaller set. The final set of dimensions of analysis were:

- *Type of object*.
- *Where* the object was located, and *how* it was displayed.
- *When* in the owner's life the object referred to.
- *Why* the object was precious, and the *nature* of the memory it represented.
- *How* it served as a memento, and
- In *what way* did it trigger memories?

The next section reports the results following this structure.

Some participants claimed not to distinguish between public and family rooms, while others clearly did, e.g. "*we use this room for proper visitors because friends would go in the kitchen and the dining room, whereas people like the financial advisor comes here"*. By observing the properties of rooms classified by most participants as public, family and personal, we were able to extend the classification to all participants: *public* - formal rooms (sitting room, lounge), *family* - informal places (family room, kitchen, dining-room) and *personal* - rooms like bedroom or study.

FINDINGS

Types of Mementos

One striking observation was that *only one* participant chose a *digital* object during the tour: "*maps. I make my own maps because I do a lot of cycling and journeys. These maps then become the memory of the occasion and it's quite vivid for me*". This was not because the other 15 people did not have any digital mementos: indeed when we later specifically asked them to describe their digital artifacts, they referred to videos, digital pictures, emails and recordings. It was also clear these digital objects engendered strong feelings: "*[video] is a wonderful way of seeing someone alive, and when you're far away I think it has even more significance*", "*lots of emails, the history of what we were doing […] feels like a record I would like to keep*". Nevertheless, despite this rich potential and their visibility in the toured rooms in the form of tapes or DVDs, only one digital memento was spontaneously chosen and talked about.

Much prior sociological and technology work on memory has studied photographs and how these are used for personal reflection and sharing [7, 12]. Consistent with those studies, we found some instances of photographs as significant mementos, especially if these were old, unique or irreplaceable in nature: "*this is my father, who died quite young, it's one of the few photographs I've got of him.*"

However photos were only one of a much larger set of objects that served as mementos. Strikingly, photos accounted for only 16% of mementos, and six people did not refer to photos at all. This does not mean that their houses did not have any photographs on display, but rather

that participants consciously selected other type of objects as the mementos they most relate to.

Artwork was another frequent choice, accounting for 28% of mementos discussed. It could take the form of *professionally* produced paintings or photographs, prints or drawings (17% mementos). An example is given by a scientist originally from France, who describes two paired paintings on display in the front room (A. is her husband, K. a close friend): "*I never thought that I would ever buy artworks, but meeting K. opened my eyes, and this is done by a French artist. A. picked it, and he knew I would love it, he just borrowed it from K.'s gallery and brought it home and said 'What do you think of that?' He was able to pick something that I totally loved … It is amazing that you could understand someone like that, and for me, it gives me peace, it's a kind of giant monk, framed, and I'm never tired of looking at it, and it's the sort of first step in discovering that art is accessible to everyone, really*"

The quote shows that the function of the painting goes well beyond the simple aesthetic. Instead it is an embodiment of the strong bond with A, who has an 'amazing understanding' of her, and K who pushed her, a scientist, to discover her artistic side. Less evident, but significant, is the connection to her roots - as the artist, like her, is French.

Another important class of artwork was *amateur* efforts produced by family or friends (accounting for 11% mementos), in particular young children's art and craftwork projects (9%). One such example was a framed print produced by the son (F) and described by the father in this way (J is his wife) (Fig. 2):

Figure 2 "*It is a print that F did... he did it very quickly at a fair... I do printing... I'm kind of interested... this is art and is really fantastic... it is also funny because when he did it he said very clearly it was uncle R... a crazy beast or a monkey is actually J's brother...we like it because he made, is very beautiful and funny but it is also a secret*."
This object is important not only because it was made by his son, but also for the special bond between father and son via the printing activity, and the shared secret depiction of another family member.

As both examples show, these artworks were valued not only for aesthetic but for other reasons, i.e. bonds with family and friends, symbols of significant aspects of their lives, and humor.

Somewhat to our surprise, mass-produced objects often served as important mementos, and account for 28%. Mundane *everyday objects* such as a cup, clock, coffee machine, golf tee, pots, cookery book, teapot, children toys, ladder, calendar, bed, stove, candle holder and books were all chosen and talked about. What make them special is the time and energy invested in using them, as from the following examples.

Figure 3: "*Object number one is this mug … which is actually broken … I've kept it because I really really like it … I will never use it again but I can't quite bear to throw it away I feel very emotionally attached to it for some reason. […] I bought it in London, when I was working in London. It cost a lot of money … it felt like an indulgence but I felt like I could. I think [it's the memory of] working in publishing, living in London and going through a sort of fulfilling patch in my career … Also I associate it with buying my first house, having it there in the kitchen in my first house…So its also an object of continuity because I think I must have had it for … Ooh … let me think I've probably had it for nearly 20 years!*"

In some cases, the value of a mundane object goes beyond its use, like in the following example where another French woman talks about a French cookery book: "*This cookery book is by Joanne Harris who wrote 'Chocolat' I often use it when cooking with my girls on special occasions like Christmas day. … she's British, but she's got a French mother […] When I first read 'Chocolat' I was thinking: 'This has to be the island [where I spent all my holidays as a child], it has to be'. And then I found this cookery book, and there's plenty of photos of the island!*"

The book symbolizes intimacies with her daughters but is also a connection to her native country and her roots via the island where she spent childhood summer holidays and where she still has a family home.

Everyday objects become mementos by virtue of what the owner has invested in them, be it time or emotion. Thus, it is not usually the physical characteristic of the objects that make them biographical, but the meaning imputed to them as significant personal possessions. This makes everyday objects substantially different from iconic and representational objects like photos and artworks. Everyday objects gain value by progressive appropriation: it does not matter if they become worn or cracked as this reflects the time passed for them and the owner alike.

Yet other participants chose what seemed to be unintuitive objects which we called *memorabilia* - accounting for 20% of mementos. These were objects with a specific function, but unlike the everyday objects they were not in habitual use. Examples here included a stereoscope, rocking horse, measuring glasses, and a set of illustrated cards.

A final class of mementos, accounting for 8% of the objects, was highly *idiosyncratic* – falling outside the above categories. They included a shell collection; pregnancy cast; a jar containing a father's ashes; child's first nose bogey; hand made lead bullet; a framed 1997 coffee shop receipt; 30 years of diaries; "objets trouvé" (e.g. a dog collar tag without a dog - *"maybe one day I'll phone this number, and find out a bit more about Barney the dog or his owner*").

Idiosyncratic objects are important for deeply personal reasons. The medieval scholar who selected his baby son's first bogies provides this motivation: "*[laughing] some people keep their child's hair, why not a bogey?[then seriously] in the middle age they believed that this things were important… bits of body were used for invoking magical powers… keeping his bogies was in line with that tradition*". Apart the humorous intention, the connection between early memories of his son and his professional interest is evident.

Idiosyncratic mementos are often intentionally created: "*the cast of my tummy when I was five months with R, I got the idea from some beautiful casts made in my friend's art gallery. My pregnancy with R was the last one and I wanted to have some memento of it, and it was quite fun to do it*."

Other idiosyncratic objects become mementos by chance because of what they symbolized: "*a receipt, from a café, in Buenos Aires for two 'submarinos', a kind of Argentinean version of hot chocolate. You cannot really see because it's faded but the date was Christmas Day, Christmas Day 1997. There's a story about that. Years ago, every Saturday Guardian*[1] *had a competition […] we won a pair of Air France tickets to go anywhere they flew! So we went to Buenos Aires for Christmas and spent New Year in Paris. So it's a sort of celebratory thing, it reminds us of our lucky win but what we didn't know at that time is that J was pregnant, so we probably wouldn't have gone if we knew. I guess that's a memory of the trip and the gift of our family*." The receipt was later rediscovered in a guidebook and framed.

In sum, we found a large variety of different objects served as mementos, although only one was digital in format. Photos, often considered as the prototypical memory trigger, were only the fourth most frequent type of object. As expected, artwork was popular, but to our surprise we found an equal number of everyday objects being invested with mnemonic significance, as well as much more unusual memorabilia and idiosyncratic objects. What makes those other objects substantially different from photographs and artworks is that the relation to the original memory is often highly indirect. They do not directly represent significant events or people, nor are they conventionally visually attractive. As will become more evident later, their selection seems to be motivated by the fact that the owner has invested emotions in them, building meanings, and spending time cultivating them.

Where in the House were Mementos Located?

The reason for asking participants to select objects from public, family and personal rooms was to explore the relation between object type and location, e.g. were photos more likely to be in family/private than public spaces? Do people put objects that connote different meanings in different locations, e.g. social relationships in public?

	Artworks	Photo	Everyday	Memorabilia	Idiosyncratic
Public	44% (P=39, A=5)	17%	25%	11%	3%
Family	38% (P=16, A=22)	18%	33%	9%	2%
Personal	15% (P=10, A= 5)	15%	27%	29%	14%

Table 1. Types of Objects and their Locations (P is Professional, A is Amateur).

Differences were found among rooms (Table 1). Public locations often display professional artwork, primarily because of their aesthetic quality. In contrast, family spaces contain more amateur artwork (e.g. by children) to reinforce relationships in areas where families spend more time. Although memorabilia are generally kept to personal zones, they can at times be on display in public rooms as objects of curiosity or conversation, like granny's fruit plate or the framed receipt described above.

Figure 4. Photos, artwork and memorabilia in public spaces.

Finally personal spaces tended to have more objects related to the self (40%) or to long past events (20%). Here we also saw more symbols of professional achievement or personal interest, as well as more memorabilia and idiosyncratic objects. The reason for this dichotomy (memorabilia and idiosyncratic objects in personal spaces vs. artwork and photos in shared spaces), is clear in the words of an informant describing her grandmother's perpetual calendar that she keeps in her study (Fig. 5):

[1] The Guardian is a popular British newspaper.

Figure 5: "*That's something I remember playing with a lot as a child [..] sometimes these things are … erm… untranslatable or "uncommunicable". I mean, [my husband] would say: "Oh, why do you keep* ***that****?"* "

In addition we looked at *where* in the room the objects were positioned. Our expectation was that objects would occupy prominent spots to serve as constant reminders of people's pasts, or to spark conversation with friends and relatives. This was true for artworks, photos, everyday objects and some memorabilia in public spaces. "*I like to have [the pots] out … people would say "Oh that's a nice pot." and I say "My dad made it, actually." So there is a sort of conversation point, too.*"

Strikingly, 25% of selected objects were not on display but put away in cupboards and drawers. In some cases the fragile nature of the object (china, glass) is the reason for storing. Often however (47% of time) the concealed objects were related to the person's distant past and rediscovering them is a special event, as discussed below.

In summary, there is a clear autotopography of rooms. There are clear differences in the *type* of mementos people use to populate their social, family and personal spaces and in the *position* they choose for those objects. Photos are distributed throughout the house, professional artworks are more likely to be found in public rooms while amateur (mainly children's) artwork is in the family room. Memorabilia and idiosyncratic objects are generally restricted to personal spaces. These differences seem to reflect different levels of intimacy with the spaces, providing good evidence for autotopographies.

What Time Period do Mementos Refer to?

We also looked at *when* in the person's life the mementos referred to. Previous research has described mementos that are typically objects from the distant past [6]. We did find some instances of objects invoking distant childhood (19%, of which 12% were early years, 7% teen-age) and youth (9%). However, the highest percentage (46%) of mementos relate to the *recent past* (the last 10 years) - connecting to current relationships and family. Another 22% of mementos refer to adulthood before marriage, as in the example of the whale mug. Finally 4% related to the interviewee's roots.

The time in the person's life that the memory refers to affects the memento's location (Table 2).

	Roots	Childhood	Youth	Adulthood	Recent past
Total	4%	19%	9%	22%	46%
Public	1%	3%	1%	4%	13%
Family	2%	3%	2%	5%	17%
Personal	1%	13%	6%	13%	16%

Table 2. Time of memory by location.

While mementos from the recent past are equally distributed in the different locations, childhood mementos are rarely found in public spaces. Those in personal areas are more likely to be related to the distant past than in other areas of the house (41% refer to youth or childhood). The high overall percentage of mementos from the recent past may represent 'memory in progress' - objects for which the owner is currently building the meaning as time passes. The example of the shells above is one such case, or as revealed in "*[the children's books] for me it's sort of transmitting the love of reading*".

Why did People choose these Objects?

The next questions we addressed were *how* and *why* these objects served as mementos.

Previous research has documented three main functions for mementos: referring to events, relationships, and the self [8]. Our findings confirm, but expand, those results. As we expected, 13% mementos represented an *important event* such as a wedding or birth, a significant period in a person's life, such as attending university, or long-term hobbies like bicycling.

	Events	Relationship	Reminiscing
Total	13%	59%	28%
Public	4%	16%	2%
Family	2%	20%	7%
Personal	7%	23%	19%

Table 3. Motivations for mementos with respect to places.

59% of objects signified a *relationship with others*. As expected, some of these objects were direct depictions of others (e.g. photos) or gifts received from others. However relationships often went beyond these simple links, e.g. they might represent *activities* done together, e.g. sculptures done in an art class taken by both partners, children's artwork from weekly visits to the library for children's story time, or the French cookery book discussed above.

A more individual function is *personal reminiscence* – where a person privately interacts with the memento to relive previous life experiences. 28% of objects were of this type. However *personal reminiscence* turned out to have multiple aspects. It could refer to *identity* – memories that contribute to the person being who they are - such as photos of ancestors, or childhood memorabilia. But it might also relate to the self in more complicated ways, such as objects that reflect interests, e.g. tools used for a favorite hobby. Alternatively they could refer to *achievements* the person was particularly proud of, such as awards, authored books, or a medal for completing the London marathon.

Object function also relates to its location, with social rooms (public and family) dominated by relationships, and personal spaces having more reminiscing (Table 3). The position of the object in the room also depends on its function (Table 4). As expected, mementos of relationships

are prominent or on display; mementos of reminiscing are prominent if they are self-referential, or concealed if they are nostalgic objects.

In contrast to previous research, in 30% of cases we discovered multiple motivations for choosing an object. E.g. personal, social and life events are all mentioned in the following excerpt where L reveals how a shell collection (Fig. 1) relates to family holidays (events), her childhood (personal), and her children's education (social): "*the shells are quite important because they are memories of our holidays, and we each year build up our collection. I had a collection of shells when I was a child displayed in boxes labelled with their names. ... This is the past six years and each time we add more. [Collecting shells] helps to entertain the kids for a long time on the beach, and [gives a purpose]. I find that if you do an activity and then you don't do anything to it, it's a bit negative, it's like you're wasting you're time.*"

		Events	Relationship	Reminiscing
Prominent	45%	6%	27%	11%
Display	31%	6%	22%	3%
Concealed	24%	3%	10%	11%

Table 4. Position of mementos with respect to motivations.

The reasons *why* an object is valued include *family bonds* (44%), *nostalgia* (20%), *aesthetic* (16%), and *moral values* (15%). The importance of mementos as conveyers of moral values was unexpected but evident, sometimes made explicit as in the excerpt above, but other times more implicit: "*my grandmother was sort of very liberal quite a modern sort of person. She was very accepting and welcoming*" (when discussing her grandmother's china).

Many participants exhibited quite strong feelings "*it's amazing that you could understand someone like that*", or in the way they held and caressed objects. As expected, happy memories were more frequent: 30% were described as 'very happy' and 42% 'happy'. But somewhat curiously, 20% of mementos did not seem to stimulate particular emotions.

Contrary to other work on photos [5], 80% of participants mentioned at least one object related to sad events, such as death or divorce. But often people talked about sad memories in a positive way, e.g. remembering positive aspects of the personality of a dead parent, or talking about the difficult times as "*having moved on*" and "*realizing how happy I am now*".

Personal spaces tended to contain more instances of objects that invoked very happy or very sad memories: 59% of very happy memories are in personal spaces, compared with 25% in family and 16% in public ones. Sad mementos are never on display in public rooms, but are located in personal (67%) or family (33%) spaces.

Summarizing, there are often multiple reasons why objects are selected. Mementos that represent relationships can be found in any room while objects related to personal reminiscing are generally confined to personal spaces. Moreover objects symbolizing relationships are mostly on display and in prominent positions. Objects for reminiscing occupy personal spaces, but are often concealed and reserved for special occasions.

How Are Mementos Invoked?

Our initial expectation was that mementos would be prominent and visible, to support functions of *personal-reminiscence* and *sharing*. We discovered *sharing* memories goes beyond the simple showing of photos of events or relations to family and friends documented in prior work [10, 5]. Such sharing can cement parent-child relationships as when a mother explored her childhood memory box with her daughter K. (Fig. 6):

Figure 6: "*this was given to me by my grandmother when I was ten, and this was given to me by my mother when I was six, and this is my Brownie Badge… I showed [the box] to K. the other day and she was absolutely over the moon, she said 'I want a locket as well, with pictures of my mum and dad in it!'* […] *You know, they've all got enormous meaning to me, but only to me now.* […] *The only people I would think about sharing, would be the children. There is nothing inherently important. It's only important because it makes a link across the generations.*"

Spending time with children to explain one's own story, or those of parents, grandparents or extended family was a recurring theme. Parents and children alike enjoy it.

Boxes and containers of memorabilia as in the example are not unusual: thirteen (80%) of our participants showed or mentioned at least one such collection. Generally collections contain mementos of distant periods of the person's life, e.g. childhood, university life, and are created opportunistically with what has survived years of sorting and clearing. Other times they are created for a purpose, e.g. wedding memorabilia chest, or a family treasures box: "*My mother picked up all sorts of lovely little family treasures: pictures of my great grandparents, my great grandmother's sewing things, my great uncles wooden carvings and all sorts of old family things. It's like a little corner of part of my life.*"

These boxes of memories are often not easily accessible (stored in an attic, or deep in a wardrobe) and rarely opened. However when rediscovered they act as 'time

capsules', a whole past world is opened and the owner is thrown back in time - deeply immersed in reminiscing: "*that's one of [my son's] first pairs of socks can you remember when they were this tiny look look look ... oh I haven't looked in here for years funnily enough ... little bootie ... oh I can't even remember those were his first pair of little booties*." Having these objects in constant view would habituate people; so concealing them makes more salient the contrast between that past world and the current one, triggering a world of nostalgia when brought to light.

At the opposite end of the spectrum are mundane objects that are often directly integrated into everyday activity: "*That was my father's step ladder, you see, and actually we have many objects of my father's around this house, even his car keys, the kids use his car keys as part of their toys ... I really like that because they're quite disappointed that they never knew him*."

Incorporating memories into everyday life was a recurring topic: two people passed their teddy bears to their children, a girl played with her mother's jewelry, a son with his father's bow, an old stove found a new place in the lounge, and a grandmother's teapot was used everyday. People seemed to derive comfort from the integration of past and future, knowing that an important aspect of their past was somehow evoked every time they made a cup of tea, or lit the stove. Embedding mementos into a familiar space changes their nature: "*these photos are in the grain of the room, they're not just there because they can be. Sticking [a photo] on [the wall] is consuming it ... I often point one out to people ... that is so and so*". From this perspective, *using* mementos is more important than *preserving* them: "*objects on display are to be used, and not to be a museum piece. From time to time something does get broken ... the other day when I was mowing the lawn I mashed up my father's car keys because the kids had left them out there […] I'd rather mash them up, knowing that the kids enjoyed playing with them for a few years rather than just have them in a cupboard*."

Participants often mentioned the periodic sorting and clearing of personal belongings, distilling out what is still worth keeping: "*that drawer is all that survived from that bit of my childhood, really. It's been weeded down year after year. And every time you go through the drawer 'Oh God! look at all this rubbish, it's gotta go.' I wouldn't want to get rid of them altogether. I very much like having them here, in my house now*". Distillation is crucial: the process of going through a small collection of memorabilia is emotionally powerful, but large boxes put people off: "*loads of cardboard boxes with loads of stuff, in general junk really. I should chuck all out but I feel I should go through it and decide what I want to keep and it will take ages so I never do ... so the boxes sit in there*". As a result the content of these large boxes has little value, as it is never accessed. Thus having a compact collection is important in sustaining interaction throughout a lifetime.

In sum, different mementos are located in different places, affording different types of invocation. Apart from being displayed, memories are integrated in everyday life through mundane objects in everyday use - signaling continuity between past and present. Of particular emotional significance are small collections of objects concealed and opened only rarely. Accessing important collections, revisiting and sorting them is an enjoyable activity, reserved for smaller collections, while bigger ones tend to be ignored as the effort needed is perceived as too great.

Other Observations

There were other recurrent observations that fell outside the above analytic scheme.

Distinct gender differences emerged. For example, women seemed to determine what objects were placed in public spaces. As a result, men did not always find it possible to select 3 of their own objects in public or family spaces, and often resorted to talking about their wife's objects - making only weak connections with them. In contrast, they were much more forthcoming in their own space, such as their study, talking about more than 3 objects in this setting.

Consistent with other work [8], there were also large differences between men and women in terms of the objects that they chose. Men tended to choose objects that referenced themselves and promoted personal reminiscence, e.g. things that signified their interests or achievements. In contrast, women's objects tend to highlight relationships with family and friends.

The role of parents (and grandparents) as curators of children's memory was also evident. Every family saved children's artworks. Keeping, however, is not only done for the children, but for the parents to remind themselves of their offspring's achievements. Grandparents have an active role in connecting generations: most memorabilia boxes had been recently passed on from the grandparents to parents to be shared with the children.

DESIGNING DIGITAL MEMENTOS

We now discuss the design implications of our findings. In particular we are interested in bridging the divide between physical and digital memories. As we noted, only one participant selected a digital object as a memento, despite the fact that we later established that all our participants had large collections of digital memorabilia. Can we integrate these currently different worlds, combining some of the mnemonic affordances of physical objects into currently underexploited digital resources, or designing physical objects with enhanced digital mnemonic properties?

Active Selection Not Capture

Few participants viewed their activities as 'capture' in the way that current technology projects describe lifelogging. Capturing a large collection of mementos and later accessing these when needed is done only with photos. Instead participants talked about sifting through and

revisiting small collections of objects, choosing highly specific items for the associations that they triggered. The size of the collection matters and large collections tended to be ignored. This may be the fate of lifelog data, stored somewhere and ignored, if the owner is not given tools for sorting, clearing and distilling what is of value. It may therefore be that the processes involved in the creation of highly meaningful memory objects are very different from the rhetoric of total capture of one's entire life. Meaning construction rather than easy search should therefore be the goal of memory technology and time spent managing digital mementos should be perceived as creative and enjoyable, a substantially different experience from standard PC use. In practical terms, we need to build tools that facilitate sifting and selecting, rather than tools to retrieve *any* event from one's past.

Augmenting Objects with Digital Memories

The *types* of mementos people value is varied. Much current work on digital memory technology has focused on *representational* objects, especially photos. However photos (and pictorial artwork) accounted for less than half of the objects people chose. One obvious implication here is that we need to extend the set of digital technologies beyond the pictorial. While some work has begun to develop technologies that allow users to interact with other types of significant objects [13, 26], we need to broaden our designs to encompass everyday objects, memorabilia and other idiosyncratic objects that we saw being talked about here. We need ubiquitous technologies that allow users to interact with and manipulate external objects, rather than focusing on the 'capture' of images of events or people. The key principles designers should keep in mind are that digital mementos have to be tangible as well as long lasting, self-contained and straightforward to access.

Non-pictorial technologies usually bear an indirect, symbolic relationship to the original memory, and it is the informant's narrative that invests them with the relevant mnemonic meaning. In contrast to a wedding or vacation photo, one cannot look at nose bogey, a café bill or teapot and infer why these might be highly significant to their owner. But if we broaden the class of memory objects beyond the pictorial, we need new technologies that allow users to annotate and provide narrative explanations for the objects they value. Our participants showed great pleasure in manipulating their mementos indicating the value of embedding recording and playing functions in the object itself [13, 26], rather than a specialized device designed for memory capture.

A Memento for Every Mood

Mementos can be invoked in different ways. They can be *displayed* in prominent places, to be seen, reflected upon and *shared* via conversations; or they can be *integrated* into everyday life through everyday objects. Finally they can be *revealed* – so that when they are uncovered they regenerate forgotten experiences relating to concealed collections of objects. However current work on digital mementos has focused largely on the first types of usage, namely *display* and *sharing*, as represented by the use of large displays such as tabletops, TVs, or dedicated photoframes. Rather less attention has been paid to *integration* or *concealment*. How might we support these types of invocation? *Integration* might be achieved through the use of augmented reality techniques whereby everyday objects such as cups, teapots or even stepladders may source memories directly, e.g. placing a RFID tagged cup in a given location triggers sounds or images from the memory period relevant to that object. Investigations of these concepts has just begun: tagged souvenirs can retrieve related photos for display on a tablet PC [26] and an augmented shelf play narratives associated with the mementos that are placed on it [11]. Although some work addresses *revealing* [13], this may be more complex to support. How can we provide dedicated containers for small classes of physical or digital objects that allow users to 'enter that past world'? A special digital container could allow depositing digital (and physical) mementos by just dropping them into it. It might be a box that could be flattened when open providing a wider surface for interaction; it should be self contained, portable and not need additional software to show its content. As an augmented object (e.g. via RFID) is deposited, additional information can be automatically collected by the container and stored locally. When, 20 years later, the owner opens the container, she will find not only the objects she put in it but additional information that was automatically added - pictures of her friends at that time, her university timetable, maps of her travels in Peru, the music and news she was listening to, and clips of her then favorite TV programs.

Memories to Fit Living Spaces

We discovered a clear relation between object types and their locations. As expected, we found different classes of objects, with different emotional character in public, family and personal settings. Again we might want to think about different design characteristics for these different spaces, or augmented environments, with the emphasis being on *display* techniques in public areas, *integration* of everyday objects in family areas, and *revealing/reflection* in personal locations. An alternative is that a single object might have different properties in each location. Thus grandma's teapot might retrieve old family photographs when placed on the family interactive table for social sharing with the cousin's family visiting; when taken upstairs to the bedroom and placed next to grandma's portrait the teapot will play the stories she was used to tell the cousins at bedtime when they were young girls spending their holidays in her house.

CONCLUSIONS

We conducted a field study to understand the principles underlying the relations between people, their memories and their mementos. People relate to a small number of objects that are carefully selected and invested with meaning. Personal reminiscing and sharing of pictorial

representations are not the only ways of relating to personal memories. Mementos are ubiquitous, but their nature and functions can be very different. Artworks in public spaces support social display and conversation, children's drawings and mundane objects in the kitchen comfort the family in everyday life, while long forgotten private memorabilia kept in a drawer unlock emotions. Mementos in inhabited spaces thus create a memory landscape of autobiographical objects, an autotopography. "an addition, a trace, and a replacement for the intangible aspects of desire, identification, and social relations" [12]. The design of technology for personal memories must carefully consider these findings to avoid creating devices that do not reflect these processes. Tangible digital mementos, everyday objects augmented with digital memories and ambient technology show more promise than the lifelogging perspective. We need to move away from a philosophy of exhaustive 'capture' towards technologies that support active remembering with multiple types of objects that can be appropriated in highly flexible ways.

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