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Remembering today tomorrow: Exploring the human-centred design of digital mementos

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Abstract

This paper describes two-part research exploring the context for and human-centred design of 'digital mementos', as an example of technology for reflection on personal experience (in this case, autobiographical memories). Field studies into families' use of physical and digital objects for remembering provided a rich understanding of associated user needs and human values, and suggested properties for 'digital mementos' such as being 'not like work', discoverable and fun. In a subsequent design study, artefacts were devised to express these features and develop the understanding of needs and values further via discussion with groups of potential 'users'. 'Critical artefacts' (the products of Critical Design) were used to enable participants to envisage broader possibilities for social practices and applications of technology in the context of personal remembering, and thus to engage in the design of novel devices and systems relevant to their lives. Reflection was a common theme in the work, being what the digital mementos were designed to afford and the mechanism by which the design activity progressed. Ideas for digital mementos formed the output of this research and expressed the designer's and researcher's understanding of participants' practices and needs, and the human values that underlie them and, in doing so, suggest devices and systems that go beyond usability to support a broader conception of human activity.
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1. Introduction

> "*meaning, not possessions, is the ultimate goal of [people's] lives, and the fruits of technology [...] cannot alone provide this. People still need to know [...] that they are remembered and loved, and that their individual self is part of some greater design beyond the fleeting span of mortal years.*" (Csikszentmihalyi and Rochberg-Halton, 1981, p. 145).

Designing for the personal sphere requires a change of perspective: from technology-focussed (efficiency and effectiveness at work) to human-focussed (aspirations and desires at home). Technological advancements and improved capabilities are undoubtedly exciting, but a blind adoption might lead to design in the wrong direction. Evaluations of implemented smart home technology, for example, showed there is still the need to better understand the environment where people live, and the meaning they attach to it, rather than simply realising new technological possibilities (Taylor et al., 2007).

In a similar vein, life-logging now allows recording of every conversation, computer interaction and piece of information encountered, as well as audiovisual logging of personal experiences (Bell and Gemmell, 2007; Kern et al., 2007; Mann, 2004). This approach fails to understand people's motivations for remembering past experiences and what they value as mnemonic representations of their lives. Some work has looked critically at life-logging (e.g., Sellen et al., 2007; Harper et al., 2008), but the starting point is still life-log data already collected. Our approach in developing technology that supports personal memories started at the opposite end and focused on motivations and values. Instead of looking at what use people may have for life-logging we looked at what they considered worth

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remembering and how technology could be designed to support this highly personal activity.

This paper describes our collaborative work as researcher (Daniela) and designer (Simon) to understand the potential for the digital equivalent of mementos, as objects that prompt personal reflection on past experiences. Such *digital mementos* (as we conceptualised them) might be digital devices to aid remembering or traces of people's digital lives that become mementos (such as the emails they send or receive, the photographs they take, the websites they visit), or a combination of both. Daniela's field studies of families' practices and objects for remembering provided insights that were developed by producing ideas for digital memento devices and software in discussion with those who might use them. Simon led this design activity applying a methodology where provocative 'critical artefacts' were used to stimulate ideation. Fig. 1 illustrates the sequence of activities and our roles in each.

Both field studies and design activity were human-centred, a term we use instead of user-centred recognising: the need to firstly understand meanings and values and the way they can affect the use of technology (Strain, 2003; Frohlich and Kraut, 2003); the need to consider the numerous stakeholders affected by a product or system as well as its users; that design should advance human dignity rather than unquestioningly produce usable, marketable or desirable products and systems (Buchanan, 2001); and that over-reliance on a single conceptualisation such as 'the user' (or 'the stakeholder', etc.) can stifle creativity (Wright et al., 2006).

In this work, reflection is not only the final products' function (ideas for digital mementos), but also the means by which the enquiry progressed. Reflection was core to the field studies, discussed in Section 3, that encouraged participants to think about their own life and what was of value to them, and what was worth preserving for the future. Reflection prompted by 'critical artefacts' was a central principle of the design methodology, discussed in Section 4, which explored possibilities for digital mementos with groups of stakeholders in an open and exploratory manner.

2. Related work

2.1. Personal memories and digital technology

While much research in HCI has looked at personal reminiscence with photos (Crabtree et al., 2004; Frohlich et al., 2002; Rodden and Wood, 2003), only a few studies explored how digital technology could support affective personal memories.

Narrative and sound has been considered very evocative in personal recollection and a few studies investigated this concept. The *Memory Box* (Frohlich and Murphy, 2000) works as a jewellery box: recorded narrative is attached to a souvenir that then plays when the object is removed from the box. Children used it as a personal journal, while adults perceived its value only if the narrative-enriched objects 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. *Sonic Gems* (Oleslik and Brown, 2008) provide a tangible interaction with sounds: an audio device is embedded in a ball-like case (a gem) and is triggered when the gem is taken out of a bowl. The design derives from a field study conducted in the home investigating the evocativeness of domestic sounds, and confirms that audio has potential for capturing sentimental memories, although much research is needed to explore effective human interaction with digital sound. The *FM Radio (Family Memory Radio)* (Petrelli et al., 2010) is a first step in this direction: technology for uploading and playing back self-registered sonic souvenirs was imbedded in an old fashion radio and evaluated with families that listened to sounds recorded in their previous year's holidays (Dib et al., 2010). The results show that a new and innovative design, departing from the tradition of technology-centred appliances, is more appealing in the home context and could afford a natural interaction with digital belongings.

Two design studies have investigated the interaction possibilities offered by enriching objects and memorabilia with sensors for the purpose of personal recollection. The *Living Memory Box* (Stevens et al., 2003) is intended to support the collection, archiving and annotation of family memories. In the design concept proposed, the *Living*

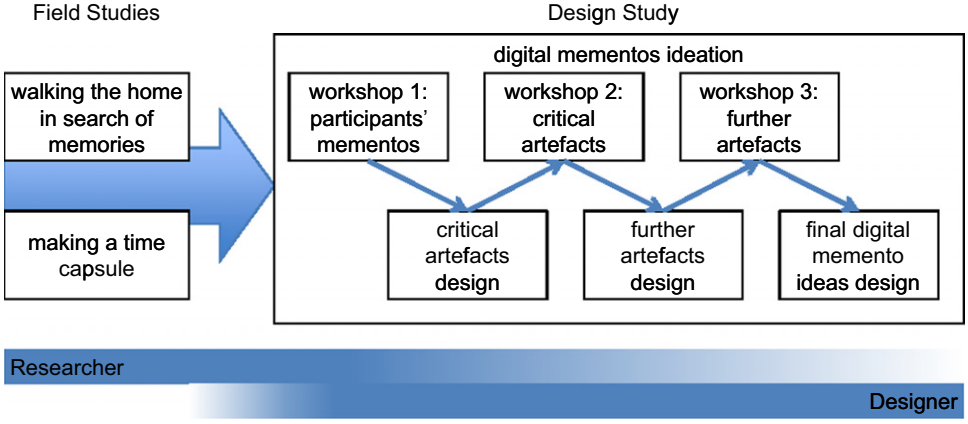


Fig. 1. Overview of field studies and design study.

Memory Box records the appearance of physical objects placed into it together with audio narratives and metadata to support later retrieval. The concept was evaluated with scrap-bookers showing that personal archival systems must be designed differently from PCs, supporting natural interaction (e.g. touch, voice). Frohlich and Fennell (2007) have explored design concepts related to objects in the home. Besides devices for visualising photographs, they discuss the *Memory Shelf* and the *Anniversary Plinth*: the former records objects' stories and triggers their playback when the object is placed on the shelf; the latter prints a long strip of paper with important facts associated with an object on important dates.

Souvenirs, personal memory, and recollection were investigated in Hoven and Eggen (2003). Souvenirs are reminders of personal experience (holiday, honeymoon) or a specific person (heirloom, gift), and are 'used' (watched, talked about); souvenirs are often idiosyncratic and carry meaning for their owner only, while their true meaning is obscure to others. With the intention of materializing digital photos, RFID-tagged objects were used to retrieve a set of images; a tablet computer supported an individual view of the image that could be sent for sharing on a television screen. A similar approach was proposed more recently by Nunes et al. (2009): the TV screen becomes the focus of the social viewing of photos associated with active memorabilia used to physically select a photo collection by sweeping the object at the TV screen.

2.2. Participatory design, innovation and critical design

Participatory design (PD) (Greenbaum and Kyng, 1991; Schuler and Namioka, 1993) ensures that the users of technological artefacts are involved in their design as informants or co-designers. This stems from an ethos that users have a democratic right to be included in design and will benefit as a result, and that doing so results in better (more efficient, usable, profitable, etc.) products and systems. Ehn (1993) refers to this as the political and technical features of participatory design. So, participatory design gives value to both human and operational improvement; it aims to produce 'happier' (empowered, enabled, valued, fulfilled) users and better products/productivity.

In PD, professional designers work together with users to explore a 'space of possibilities' for technological artefacts based on their combined knowledge and experiences. Such approaches generate products that reflect participants' current practices and expectations as 'users' but are often less useful at generating novel products which they can appropriate for new practices and roles for technology relevant to their lives. A quote, often attributed to pioneering car manufacturer Henry Ford, characterises the challenge:

> "*If I'd asked people what they wanted, they would have asked for a better horse.*"

Ford's customers did not know the potential of motorised road transport, so could not say what they wanted from it. The motorcar was outside their space of possibilities. To develop innovative ideas using PD, designers and other participants need to be able to envisage a broader space of possibilities, from which to agree relevant solutions. In the methods described below, provocative conceptual designs are used to facilitate this broadening (Gaver and Martin, 2000). These artefacts relate to the products of Critical Design and similar practices.

Dunne (1999), Dunne and Raby (2001) propose Critical Design as an alternative to mainstream "affirmative design". The products of critical design are not explicitly intended for manufacture and sale, rather they provoke reflection in their audiences (and are frequently encountered in galleries, e.g. (García-Antòn et al., 2007; Blauvelt, 2003)). They express alternative social practices, values and technological possibilities that critique the assumed roles and functions for electronic products (such as Dunne's devices that draw attention to the physical phenomena of electromagnetic waves). In Dunne's words:

> "*Critical Design uses speculative design proposals to challenge narrow assumptions, preconceptions and givens about the role products play in everyday life.*" (Z33, 2007)

Such 'design for debate' is not new, Italian new wave designers such as Archizoom and Superstudio were critiquing contemporary architecture and design from the late 1960s (Branzi, 1984). However the increasing prevalence of digital devices in everyday life has resulted in a number of challenges to their uncritical design, e.g. the social roles of mobile phones (Ideo, 2002). Whilst some of these designers explicitly link their work to Dunne's Critical Design, others produce artefacts for similar ends, e.g. the "fictional products" of Human Beans (2008) and Naylor and Ball's (2005) "design poetics" of mature products such as office chairs. Each of these 'Critical Design Practices' (as we term them) shares an intention to prompt their audience's reflection on their assumptions (further discussion and examples in Bowen, 2007; Bowen, 2009).

'Critical artefacts' (as we term the products of Critical Design) prompt their audience to reflect on their assumed possibilities for design, its products, and their associated and afforded practices. In reflecting on the alternative possibilities (for design, products, and practices) expressed by critical artefacts, their audience recognises the restricted possibilities that they had assumed and can therefore envisage new possibilities. These artefacts-as-critiques have a similar role to critical theories (Geuss, 1981; Calhoun, 1995; Dant, 2003) in that they seek to transform as well as express understanding (discussed further in Bowen, 2009).

In Critical Design Practices, the designer's involvement generally ends with the production of critical artefacts. Others have discussed using reflection within the research and design process to address the limitations imposed by researchers' and designers' conceptualisations of their practices and contexts (Agre, 1997; Sengers et al., 2005). We have employed the reflection prompted by critical artefacts to further inform the design activity. Returning

to our discussion of PD, participants' assumptions limit the 'space of possibilities' for design. The reflection prompted by critical artefacts is used to broaden the space of possibilities for participants to explore. We applied such a 'critical artefact methodology' (Bowen, 2009) in devising innovative proposals for digital mementos as described in Section 4.

3. Field studies: current practices for remembering

3.1. Understanding human values via reflective tasks

Despite their innovative perspectives on technology for autobiographical recollection, most of the work in Section 2.1 used traditional approaches (e.g. workshops and focus groups) to understand reality and feed the design process. However, to design technology devoted to personal reflection, new research methods more focussed on human values are needed. This section summarises two studies that Daniela led to better understand the realm of autobiographical memories. The two approaches are very different to one another but share the core idea of putting the participant in charge and seeing their individual reality through their eyes.

Although this approach borrows from many field-research practices, it also differs in many ways. As with ethnography, we put the human and their world in the centre, but we gave participants a trace to follow, an idea to develop creatively for their own pleasure. Participants steered the activity and we were happy to be sidetracked 'down memory lane'. The data collected in the studies reported in Section 3.2 was rich in nuances, full of autobiographical stories, and needed a degree of interpretation to extract insights from affective accounts to feed the second part of the research, the design-led workshops discussed in Section 4.

3.2. Walking the home in search of autobiographical memories

Only some aspects of the study are reported here; more detailed discussions could be found in Petrelli et al. (2008) and Petrelli and Whittaker (2010).

3.2.1. The study

The first study looked at why and how a material object becomes a *memento*: among the millions of objects people encounter in a lifetime, only a few become affective reminders of people, places or events. The aim of the study was to find out the driving principles and gain inspiration for the design of digital technology for personal recollection.

The home was chosen as the place to study as a space created and cultivated as a 'container' of the owners' intimate self, beliefs and aspirations (Bachelard, 1964). We focused on families with young children: parents have memories of their own lives before meeting their partner; shared memories as a couple; and are generally highly active as curators of their children's 'future' memories.

The 16 participants were asked to take us on a 'memory tour' of their home, pick up three objects in three different spaces (public, family or personal), describe what the memento was and why it was important. This very loose task left much space for personal interpretation and indeed the variety of objects and spaces we saw was richer than we anticipated. Objects chosen ranged from highly idiosyncratic ones, e.g. a father's ashes, to mundane objects, e.g. a mug; spaces included predictable rooms like kitchen and study, but also unexpected corners like drawers and a pantry door.

The tour provided a very rich canvas for contrasting digital mementos discussed in a semi-structured interview: "*You have shown us several mementos: do you have 'special things' that are in electronic form?*" With informants we explored the whole landscape of digital memories, from emails and music to more traditional media like photos and videos. To compare with the material world we asked *where* digital mementos were kept (desktop or laptop computer, external hard drive, CDs, mobile phone, etc.), *how* and *when* they were accessed and used.

3.2.2. The results

The first reaction when questioned about digital mementos was denial. Then, participants seemed to discover that they actually had digital mementos and how important they were: "*I've changed my mind, I think I do, yeah, I think I can have a sentimental attachment to stuff in [the computer], yeah*", "*They are special but I don't think about them, I'd completely forgotten we'd had them*".

The central weakness of current digital technology for personal memories is inaccessibility and lack of integration into everyday life. Consequently they are forgotten, even by people who have invested hours in collecting and organising them, being seldom invoked except on special occasions. Digital objects cannot be distributed around the house to express and elicit different styles of remembering (e.g. a photo of grandparents on display all year around can suddenly spark stories of their lives when a daughter asks her mother about it) or left in a drawer to be rediscovered by accident. Indeed rediscovery is loaded with emotions, a world of nostalgia when brought to light (Fig. 2).



This closed, metal vase lays on the mantelpiece in the lounge. Inside is a collection of the son's first things.



"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."

Fig. 2. One of the mementos chosen in the memory tour, a container of memorabilia, and the participant's comment when opening it.

In general digital mementos require an explicit intention and a lengthy process to be accessed: "I haven't got a compatible driver so I can't actually look at the disc that we've got with all the kids photos on so I have to look at them on his computer because I need to upgrade mine". Physical objects are more democratic. They may be of particular significance to just one person, but are accessible to everyone. The barriers to access digital objects are often compared with the straightforward pick up of physical prints: "I can just kind of flick through and I do that in a way I wouldn't just sit and look at stuff on the computer."

A clear distinction between digital and material is that the current experience with digital is shaped by work and as such carries feelings that do not apply to the personal sphere. Adjectives used by our participants to describe digital are "*dull*", "*impersonal*", and current technology is considered "*too much like work*". They also expressed concerns on the fact that "*digital does not last*" and "*it is ephemeral*" leaving a sense of uncertainty and diminished value.

In summary the study pointed out the limitations of current digital technology and the properties digital mementos should have: being easily accessible and immediate; being in the space and easy to be rediscovered; being self-contained and lasting without any need for attention (e.g. migration to new hardware); they should be fun and personal, appealing and intimate "*like handwriting.*"

3.3. Building tomorrow's memories today: making a time capsule

3.3.1. The study

The purpose of the second study was to understand the nature of long term remembering: what, of their current life, people would like to remember in the far future; to identify which elements of their digital lives would be worth preserving and how technology should support it. We asked 10 families with young children to make a *time capsule*[1] to be opened in 25 years' time. This process of deliberately composing future-oriented mnemonic representations in a time capsule was a playful way to engage our participants in reflecting on their daily lives and memories in the distant future.

Before constructing the capsule and its content, we asked participants to reflect on what they remember or wished to have kept from 25 years ago, and what they might want their grandchildren to know 25 years from now. We left material to keep a 2-week diary, and a local map with stickers to introduce participants to the notion of careful information capture and the procedures and goals of life-logging. No restrictions were given except that each family member should contribute to the time capsule. We explicitly asked participants to include digital objects in any form. It was made clear that sensitive content could be included in a sealed form and would not be inspected, but an idea of the content should be provided.

[1]A time capsule is a collection of objects and/or information, often sealed and buried, intended to communicate to people in the future.



[Mother] *"Mainly family memories really. Just what we do today, a snapshot of our kind of life today."*

[Father] *"We'd like to see how things were now. You know, it would be interesting to see how we were as a family in trends and how the things around us were. This is why it came out like this: we and our friends and things around us like technology, the street outside."*

Fig. 3. One of the ten time capsules created for the study and participants' comments.

"I enjoyed it, well I could carry on it's a sort of semi-permanent thing for me ... it's a sort of archive"



Fig. 4. A very rich time capsule and its owner's comment.

When the family felt ready, after about a month, they presented the time capsule and its contents to us. During the final videotaped one to two hours meeting, family members described each object, explaining what it was and why they included it. A short interview on the whole experience concluded the study.

The capsule and its content were catalogued and then returned to the family for their final storage.

3.3.2. The results

With 369 objects, the content of the ten capsules was very rich in terms of both types of objects and media (Fig. 3): here we report only the points related to this paper (further details in Petrelli et al., 2009).

Every time capsule captured a different 'family personality' (Figs. 3 and 4). Each family had a lot of discussion on what to include and spent a lot of time actively making or collecting objects that would describe their life in some detail: school books and awards, birthday presents, writing and artworks, pictures of the home, the garden, the favourite places. Some families tried to capture today via newspapers, shopping bills, samples of technology (e.g. film camera, mobile phones, Tamagotchi[2]). A few parents wrote to their children: the history of their family, their hopes for their future, reflections on their parenting.

Reflections around the time capsule were not always merry: "If I leave to open this 25 years later I will be 80. It is a pretty strange thought with my mother dying recently. It does focus your mind on the transience of things the fact that one day if you are still around you will be out and Anna will be in her 30s… sobering thoughts." This deep reflective

[2]A 'digital pet' interactive key fob.

stage was key to engage participants; it induced them to spend a considerable amount of time and energies in making and collecting objects for the time capsule (Fig. 4).

Digital is still seen as a problem. Only 20 items of the 369 across the 10 time capsules were digital, a further 40 were originally digital, but have been printed: digital photos, scans, instant messenger communications, Bebo pages.[3]

All the families had experience of the consequences of a fast changing technology and the inability to use old formats. To preserve the digital, three families took the pragmatic approach of including devices (a laptop, a CD player and an iPod) to be able to access digital data in the future. Three other families included digital storage (1 CD, 1 USB memory stick, 1 digital tape) expecting the technology to persist or to rely on experts to migrate their digital material into future formats: "*maybe USB will still be readable on old computers or maybe not.*"

In summary, families were interested in capturing a wide range of their everyday life as well as the most common aspects of today's society. Whilst this was an easy task with material objects, it became problematic when mediated by digital technology. All participants used the Web daily, but none captured the online experience of shopping or reading the news. There is no trust that digital will last: technology to last generations must then be self-contained.

4. Design study: new possibilities for remembering

Daniela's fieldwork results provided a deep understanding of the desired properties and motivations for effective digital mementos, but were largely interpretative and related to participants' *current* practices and needs. At this point we developed the idea of collaborating to design digital memento devices that would both embody this understanding and develop it further by exploring *new possibilities* for practices and roles for digital technology with those who might use such devices. To accomplish this, Simon led a series of discussion workshops following a critical artefact methodology, introduced in Section 2.2 and described further below.

4.1. A critical artefact methodology

Our design work employed a methodology intended to foster human-centred innovation. It suggests a method of generating ideas that is described in more detail in Bowen (2009) but, in brief, involves using provocative proposals for what '*could* be' to determine what '*should* be' as facilitated by designer's and participants' subjective interpretation of each other's understanding developed and expressed through artefacts and their engagement with them. Typically, this critical artefact methodology is applied via a series of workshops. Fig. 1 shows its application in the digital mementos ideation work.

As noted in Section 2.2, critical artefacts (the products of Critical Design) could be used to broaden the 'space of possibilities' explored via participatory design. They enable participants to recognise that the possibilities they assume (for design, its products and their afforded practices) are limited, and to envisage new possibilities. This operation relies on participants' reflection on the alternative possibilities that critical artefacts express. The design of critical artefacts and the form of participants' engagement with them is therefore key. In this methodology, participatory activities inform the design activity in a particular manner (participation is not co-creation).

The designer participates in group discussions centred on artefacts with the intention of developing their understanding of participants' current practices and needs, and potential new practices and roles for technology that could become part of participants' lives. However this understanding is tacit as, during the workshops, the designer's attention is on what they will design next rather than producing an explicit description of those practices, needs and roles (Polanyi's (1966) concept of "indwelling" offers a description of this process). Following this rationale, the process begins with participants' engagement with artefacts and ends with designed artefacts that are informed by this engagement.

Discussion of existing artefacts gives the designer insight into participants' current practices and needs which, in part, they can then challenge through the critical artefacts that they design. These critical artefacts then 'open up' the design exercise by broadening the 'space of possibilities'. In reflecting on the provocative (strange, alien or unusual) possibilities expressed in critical artefacts, participants can envisage new practices and roles for technology. Their ongoing engagement with the critical artefacts can also provide the designer with a tacit appreciation of participants' needs in respect of the newly envisaged possibilities. The designer can then 'close down' the design exercise by producing a further set of artefacts that suggest which new practices and roles could fit participants' lives and values. Participants' engagement with these further artefacts then enables the designer to refine and resolve their ideas into proposals for products that should be both innovative (affording new practices and roles for technology) and human-centred (having relevance to participants' lives and values).

This suggests a progression from critical artefacts for 'opening-up' to further artefacts for 'closing-down'. The earlier artefacts are therefore more provocative but progress towards being more 'prototypical' (suggestive of an end product or direction for the design activity) as the designer's tacit understanding of participants' practices and needs develops. Such a process relies upon cycles of subjective interpretation: designers develop and express their understanding through designing artefacts and workshop participants reflect upon and express their understanding via their engagement with these artefacts.

4.2. Designing and discussing digital mementos

4.2.1. The design study

A series of three, one-hour workshops were set up to explore the design of digital mementos. This study was used

[3] www.bebo.com is a social media network.

to refine Simon's design methods and his previous work (Bowen, 2008) had suggested that open-minded and imaginative participants attuned to the possibilities of novel situations (as might be afforded by the creation and use of digital mementos) would usefully inform the design activity. As such, two separate groups participated in the workshops: one filtered to have such characteristics and another group recruited from participants in Daniela's fieldwork (discussed in Section 3). The filtered group engaged with the artefacts in a more open and exploratory manner than the fieldwork group, which was more productive for ideation and consequently their workshops are discussed here as a more representative illustration of a critical artefact methodology in action. This group consisted of three men and three women in their 30s (one in their late 40s), unfamiliar with the previous fieldwork, and recruited as being open-minded/imaginative and potential users of digital mementos (using digital technology in their personal lives and at a life-stage where numerous personal memories were being made). The recruitment method, rationale for identifying 'suitable participants' and differences between the two groups is discussed further in Bowen (2009).

The workshops ran over four months and were held in our own homes during the evenings to promote an open, informal environment for discussions. Participants were told that the workshops would be a 'dialogue' between them, as potential users, and Simon as a designer. Daniela acted as observer. Workshops were video-recorded for later reference.

4.2.2. *The first workshop*

Participants were asked to bring two objects along to the first workshop that they might put into a (hypothetical) time capsule to be opened in 20 years' time. During the workshop, each person in turn shared their objects and reasons for choosing them, with the discussion then flowing freely as others made connections with their own experiences. Participants brought in a broad range of objects (from photos to a rock tour T-shirt), and discussed the events, places and people they represented and how they used them for remembering. The discussions illustrated how some objects are purchased specifically for future remembering (a pair of fridge magnets, an ethnic statuette) whilst others are obtained for practical purposes and later kept as mementos of an experience (a small bell worn to prevent startling bears whilst trekking in Canada), and how people use some objects to prompt frequent remembering (a souvenir tankard from a special holiday in everyday use) whilst others are for more infrequent and directed remembering (a newspaper from the participant's wedding day stored in a box of keepsakes).

Along with features suggested by Daniela's fieldwork such as making digital mementos easily accessible and self-contained, the first workshop discussions suggested aspects of physical mementos that we wanted to explore in digital mementos including: keeping a variety of digital artefacts as mementos, how forgotten records of people's 'digital lives' could become mementos, and how digital mementos could be discovered and discoverable. Simon designed a set of critical artefacts that proposed how these aspects could be realised and, rather than being explicitly intended as practical proposals, instead expressed alternative practices and applications of technology to challenge participants' expectations of what digital mementos could be.

4.2.3. *Critical artefacts and the second workshop*

At the beginning of the second workshop a series of PowerPoint slides were shown to 'set the scene' by illustrating the increasing application of digital devices in personal life, and reminding participants that once seemingly fantastic designs are now part of everyday life (such as the mobile phone's resemblance to the *Star Trek* communicator). Each critical artefact was then presented in turn, described as 'conversation starters' to 'continue the dialogue', and participants were asked to discuss and explore the situations that they suggested.

Participants were shown basic mock-ups of the critical artefacts along with specific usage scenarios via series of PowerPoint slides. Their use was described in relation to previous or imagined memorable events in Simon's marriage (first date, wedding, honeymoon, first child). The four critical artefacts – *Txt Globe*, *Aroma-mouse*, *Mem Eggs* and *Once Upon a Web* (Figs. 5–8) – explored aspects of digital mementos inspired by the previous activities.

4.2.4. *Second workshop discussions*

Our intention was to challenge participants' assumptions of what digital mementos *could be* during the second workshop. The critical artefacts were provocative in that they suggested alien applications of technology (a Bluetooth snow globe, a 'Wi-Fi drawer freshener', a device that determines if and when it can be used), unusual practices (devices to be deliberately lost or for rating 'happily ever after'), and alternative forms of memento (mouse-eye views and web forms). They also expressed technological possibilities such as making digital information visible, tangible and self-organising. We also hoped that discussing them would provide insights into which new practices and roles for technology might fit participants' lives and values. To illustrate this we refer to two artefacts' discussions below.

Following the presentation of *Aroma-mouse* the initial discussion centred on its practical implementation (would

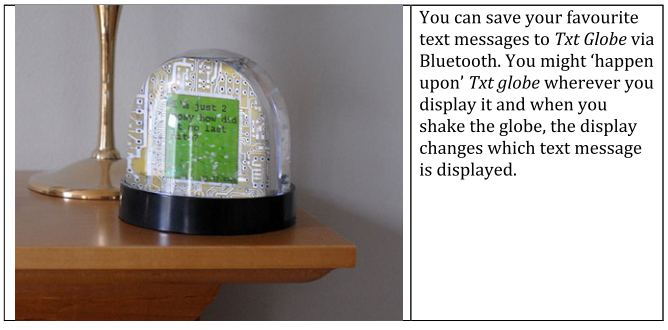
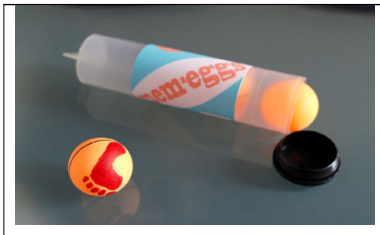


Fig. 5. *Txt Globe*: making text messages accessible and discoverable.



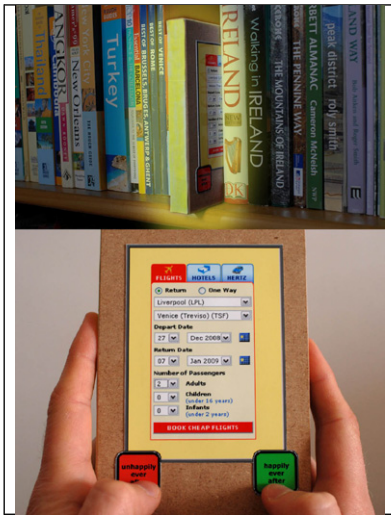
Aroma-mouse gives off a pleasant fragrance, you could put it in a drawer with your socks to keep them smelling fresh. Via a wireless connection it also stores 100 pixel square images of the web links you visit on your home computer. If discovered forgotten at the back of a drawer, clicking on *Aroma-mouse*'s buttons cycles through the stored 'mouse-eye views' on its small screen.

Fig. 6. *Aroma-mouse*: replaying 'mouse-eye views' of visited web pages.



Mem-eggs come in multi-packs. Once switched on, a *mem-egg* wirelessly sends a unique code to all compatible devices in range that is then used to 'label' all photos, videos or messages that are created whilst it is active. *Mem-eggs* can then be used to retrieve media (assuming it is stored centrally on the Internet), whichever device or whoever has created it, and can be written on or decorated to personalise them.

Fig. 7. *Mem-eggs*: labelling and sorting digital recordings automatically.



Once upon a web is a device that you might put amongst your travel guidebooks. It is also wirelessly connected to your home computer and stores copies of the website forms that you submit. Occasionally, at random, the device's spine glows indicating that it has turned on. At this point it shows web forms stored from one or more years previously. You can then choose to rate forms as 'happily ever after' or 'unhappily ever after' according to whether they should be kept as mementos (and shown again) or deleted (for boring tax returns, perhaps).

Fig. 8. *Once upon a web*: 'happily ever after' web forms?

the device record too many web pages, could web pages be chosen rather than automatically stored?), useful comments if we had intended to refine it into a finished product. However the aim was to provoke participants' reflection on what they considered possible. As the discussion continued, participants moved on from questioning the specifics of the proposed devices and started to explore how they could fit into their lives:

> *P1: "perhaps there're things when you click on at the time you don't think there's much significance but [...] I'm thinking when [we] booked our flights and accommodation when we went travelling [if] I could just have a little glimpse of some of the links to the different booking websites and so on, that would probably trigger the memory for me [...]"*

> *P2: "with digital you are losing a hard record of what you've seen."*

> *P1: "with booking significant things I've got all the emails, I've still got all those from things years gone by that I've just kept almost like as a digital memory I suppose [...]"*

> *P2: "[Aroma-mouse] reminds me of going in [my Mum's] loft and you see all your old school books and things which maybe you wouldn't be able to do now.. if I was studying now I don't know if I'd have an exercise book."*

With *Once upon a web*, although participants commented on elements that they did not like (the use of web forms), their discussion suggested other features that they did find desirable:

> *P3: "part of that is my favourite one so far because there's something quite magical about having a hardback book on a bookshelf that's slowly glowing.. [but] I would probably choose to transfer something other than forms onto it because I find forms a bit uninspiring."*

Another participant made connections between the practices the device afforded and her own experiences:

> *P4: "I keep photographs all over the house and once in a while I walk past and think 'oh I haven't looked at those for a while' and I take them out and look at them, I love that. This would give me a chance to do that digitally."*

Discussing this critical artefact also prompted further reflection on *Aroma-mouse*:

> *P4: "the more I think about the mouse the more I think actually, if I had one, I probably would use it [..] and it's just a nice little personal moment that you can think about your past.. but I do think it's quite pointless in one sense but then art doesn't always have to have a deeper meaning does it? It's just a moment for you to share with your history I suppose."*

Whilst participants did not want to own or use the critical artefacts as presented, discussion of them appeared to broaden the 'space of possibilities' for digital mementos.

In discussing *Aroma-mouse*, P1 starts to appreciate that digital mementos might be more than just photographs, that snapshots of his online activity could act as mementos, and P1 and P2 begin to appreciate a need to capture elements of their 'digital lives' for later remembering. The discussions also suggested which aspects could be relevant to participants' practices and needs, such as *Once upon a web's* 'magical' quality and potential to prompt an act of remembering.

Participating in the discussions informed Simon's tacit understanding of the participants' values and the features digital mementos should offer as result. This included making digital data (as mementos) somehow tangible, digital mementos being discoverable serendipitously and affording intimate 'personal memory moments'. This understanding was developed and expressed in a further set of artefacts.

4.2.5. Further artefacts and the third workshop

Rather than being critical artefacts to challenge assumptions, the artefacts presented in the third workshop were intended to resolve ideas for digital memento devices that would be both innovative and relevant to participants' lives and values. Simon designed these artefacts to 'close down' the design activity by expressing features the previous fieldwork and two workshop discussions (and his reflection on them via designing) had suggested were desirable and practical. Participants' discussion of these artefacts would then develop and verify this understanding. Again the workshop was presented as 'continuing the dialogue' with each artefact presentation followed by a discussion of 'what if (these devices existed)?'. Basic mock-ups, scenarios and PowerPoint were used as before.

Four artefacts were presented. *Txt-Bowl* and *Web Trails* derived from two of the critical artefacts and tested their desirable elements in a more practical form – a bowl for storing the contents of your pockets as well as displaying stored text messages and a 'magical' device for replaying graphical 'trails' of the websites you have visited. *Previously… Widget* re-examined the ideas expressed by *Aroma-mouse* by suggesting personal computer software to capture the names of files you edit for longer than 30 minutes and then randomly remind you of them one year in advance. More specifically, *Channel Pix* (Fig. 9) developed the ideas of mementos being discoverable by serendipity and affording 'personal memory moments' as informed by the discussions of *Once upon a web* and *Aroma-mouse*.

All the participants stated that they liked *Channel Pix* and discussed the beneficial experiences they recognised it could offer. E.g.:

> *P5: "I like the fact that it almost encourages you, saying you're wasting time, do something productive here's something important to look at."*

As the discussion continued, participants offered amendments to the device to tailor it to their needs, such as being triggered by moving around the electronic programme guide (EPG) in addition to 'channel surfing'.



Channel Pix is a device within your television (or its set top box) that monitors your viewing behaviour. If you begin changing TV channel several times without lingering on any in particular ('channel surfing'), *Channel Pix* detects that you might be bored and instead displays a random personal photograph. Pressing a particular button on the remote control then allows you to browse your photographs on your TV, or ignoring it means you can continue 'surfing'.

Fig. 9. *Channel Pix*: watching your memories.

4.2.6. The results

In the third workshop, participants discussed artefacts that expressed our understanding of their current practices and needs, and potential new practices relevant to their lives and values. To follow the methodology discussed in Section 4.1, the designer (Simon) then reflects upon these discussions and expresses their understanding by designing a final set of artefacts. So, Simon produced five ideas for digital memento devices and systems that embodied the understanding we had developed from the fieldwork, the three workshop discussions and the artefacts designed in response. This final set of designs, described in Section 4.3, then expresses our understanding at the end of the project of current and potential new practices relevant to participants' lives and the human values that underlie them. They effectively express our proposals for designing human-centred digital mementos (such as being "serendipitously discoverable" and "not like work"). As such, they reflect a broader range of human practices and technological possibilities as enabled by the participants' engagement with the critical artefacts.

4.3. Design ideas for digital mementos

4.3.1. Channel Pix

The *Channel Pix* artefact (Fig. 9) presented at the third workshop was taken forward as an output as participants unanimously liked it and we felt it adequately expressed our understanding at the end of the project.

4.3.2. Txt Box

Txt Box (Fig. 10) is a place to put all your personal 'clutter' when you enter your home – your keys, loose change, and mobile phone. However it does more than just keep your entrance hall clutter-free. *Txt Box* can communicate with your mobile phone via Bluetooth and download your forthcoming diary. When you lift the lid and take your phone, *Txt Box* detects your phone has been removed and may remind



Fig. 10. *Txt Box*: memory moments as you leave home.

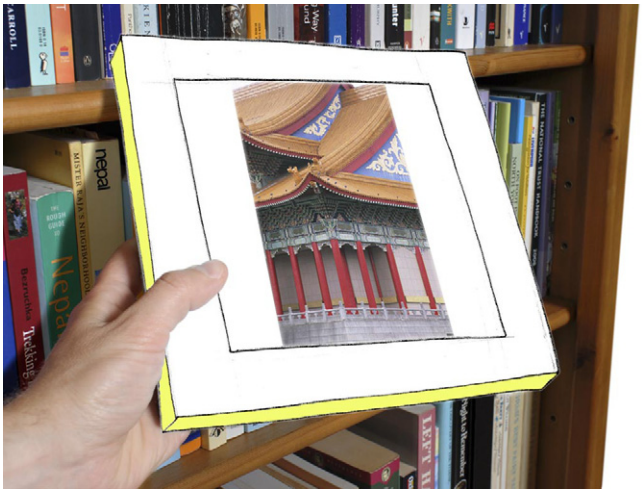


Fig. 11. *You WERE Here*.

you of any appointments. But it also copies any text messages (SMS) that you have saved on your phone for longer than six months. When the text messages are over one year old, it will occasionally display one and give you a reminder of a past memory before you leave the house. And because *Txt Box* recognises which phone has been removed, you will only see your own appointments and saved text messages.

Txt Box demonstrates making text messages tangible and easily accessible whilst also responding to participants' expressed need for a useful device.

4.3.3. *You WERE Here*

This device (Fig. 11) sits unobtrusively amongst your books (akin to *Once upon a web*, Fig. 8). It connects wirelessly to your home computer, the Internet and mobile phone networks (which know your phone's location according to the network transmitters you are nearest). *You WERE Here* keeps a record of when and where you've been outside your normal everyday journeys to work, etc.

Occasionally, on the anniversary of your travels, *You WERE Here*'s spine starts to glow, attracting your attention. If you pick up the device its temperature sensor turns on its display, and it shows photographs of your travels from one, two or more years ago. In this design proposal, it finds these photos from the global positioning system (GPS) location data your camera records with each image.

You WERE Here develops the idea of a 'magical' device that prompts moments of personal remembering, and attends to the need for digital information to be self-organising.

4.3.4. *Previously… Widget 2*

This second version of a third workshop artefact deals with participants' concern that it was too intrusive. *Previously… Widget 2* is software on your home computer. If you've been using the same application for longer than fifteen minutes (clicking on things with a mouse, typing), then the software starts 'remembering' what you were doing by saving a screenshot of the application. Of course, you might not want the software to remember what you were doing, in which case you can click on its icon and 'blindfold' it. Then, when you come to shut down your computer *Previously… Widget 2* (Fig. 12) will occasionally remind you of what you were doing with a screenshot.

Previously… Widget 2 demonstrates capturing aspects of people's 'digital lives' to act as prompts for remembering in the future. Some of the screenshots could then 'grow' into being mementos, although others may not if recalling less personally significant moments.

4.3.5. *Mem Tabs*

This idea assumes a 'digital utopia' where all data is stored and accessed directly on the Internet rather than on individual devices, e.g. a camera sends photographs wirelessly to central servers rather than saving them onto a memory card.

Mem Tabs (Fig. 13) are a product from this digital utopia – little tablet-shaped devices that you buy in packs. After turning one on by squeezing it, it transmits a signal to any *Mem Tab*-enabled digital device within a short range for one day or one week (depending on the type you bought). Each *Mem Tab* has a unique number and any devices in range will label any files they create with this number.

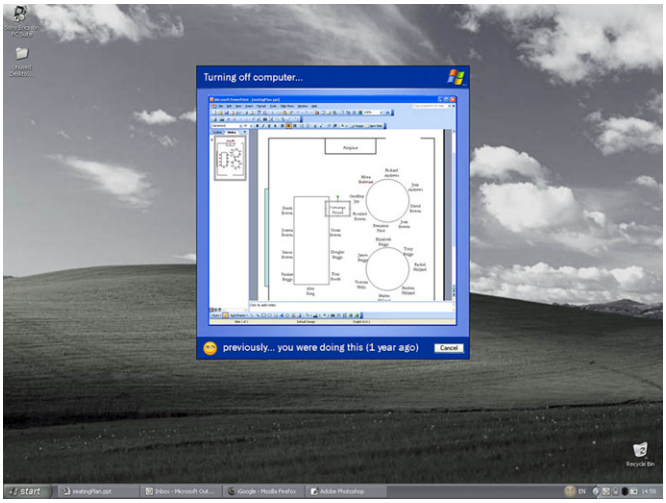


Fig. 12. *Previously… Widget 2*: something you did earlier.

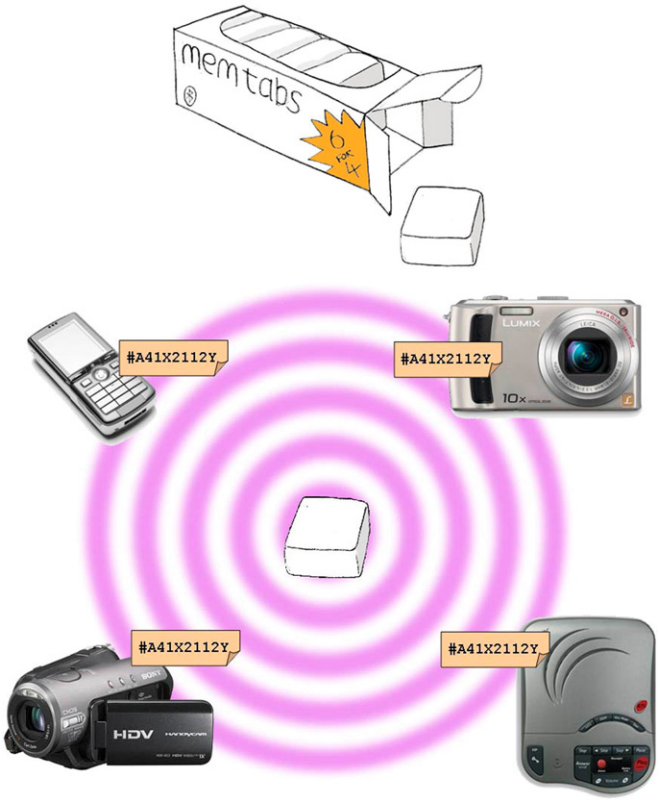


Fig. 13. *Mem Tabs*: labelling your digital media.

So for example, if a couple are at the hospital having their first child and activate a *Mem Tab*, all the digital files created in range will be labelled with its number: the text messages from their mobile phone, the photos from the new grandparents' camera, even the security camera recordings.

To re-play digital media from a particular event, just place the appropriate *Mem Tab* on a reader next to a playback device (such as a television), which will then display all digital files labelled with that *Mem Tab*'s number. Two *Mem Tabs* will display all the files with both labels, etc.

A refinement of the *Mem-Eggs* critical artefact, this demonstrates self-organising digital data and a product for easily accessing it that can be fun and personal.

5. Discussion: designing digital mementos for and with reflection

In this paper we have discussed how we explored possibilities for digital mementos by understanding their human context (through field studies – Section 3) and developing this understanding by designing (via artefact-centred discussions – Section 4). Our intention is that such digital devices and systems should support people's reflection on their past personal experiences (memories). We can then offer guidance on designing *for* reflection based on our experiences in this two-part research. And, as we will discuss in Section 5.3, our use of critical artefacts also demonstrates a method of designing *with* reflection.

5.1. Understanding user needs and human values

As discussed in Section 1, designing human-centred devices and systems means considering more than usability. In addition to people's current needs as 'users', we should understand the human values that drive their practices, which provide insights into new possible functions ('uses') supporting a broader conceptualisation of human activity.

The field studies looked beyond participants' practices and identified both their needs (e.g. "don't want to organise my digital stuff, let the computer do it") and underlying human values (e.g. un-sought for moments of remembering in daily life). This is necessary as considering people as 'users' alone could privilege utilitarian 'work-like' designs, whilst we recognise that a focus on values alone could leave technological problems unresolved.

This design shift from technology optimised for 'use' to supporting human values changes which features are important, e.g. efficiency is meaningless when revisiting memories happens once every 5–10 years. For the owner, the value is not the frequency of access but the emotional investment captured by old mementos rarely accessed:

> "In the attic I have a box full of things from [..] 30 years ago, but I never open it. I just move it around. When I move house, I look, I open it, ah! I go look at this and then I close it again. I don't wanna throw it away. How many times have I looked in that box of mine? About once every ten years."

A change of perspective from user to human calls for a change in approach to field studies. It is helpful to design the study in such a way that participants can appropriate the activity, exercise their creativity and describe and represent their own lives (as those best positioned to do so). Participants find such activities valuable, not in terms of given rewards (money or gifts), but in doing something that is precious and satisfying [commenting on the time capsule study] "*I would have never done it, but there was a reason and it was just fab. I enjoyed it greatly!*". Such studies also motivate continuing participation and consequently provide more insights: "*It has been very interesting, we have done a lot of things and caught a lot of things for this that we would have probably have let slip by*."

The time capsule activity gained enthusiasm because participants kept the product: it was a work done for themselves, not just for the researchers. The memory tour produced a rich set of stories because of the attachment between the person and their memento. Material collected in this way may be more difficult to use as factual evidence to justify design decisions because some interpretation is required, a subjective interpretation by the researcher through the lens of their personal experience. However the needs and human values that are identified provide a useful basis for imagining and designing truly innovative technology.

5.2. Designing digital technology for reflection

Understanding human values is particularly important when designing devices for personal reflection, where other factors

may have more importance than usability such as ambiguity, playfulness and (as we found with *Once upon a web*) 'magicalness'. Therefore, in understanding the context for such design work, we should appreciate current practices and needs but also gain a deep understanding of the aspects of personal life we intend to affect (in our case autobiographical memories).

In our work, if we had designed artefacts to evaluate the social and technological functions suggested by the fieldwork directly ('prototyping') we may have only explored a restricted 'space of possibilities' (for social practices and applications of technology). Instead, we used critical artefacts that expressed alternative and provocative possibilities (informed by the fieldwork) to encourage participants to reflect on these alternatives, recognise their assumptions and envisage new possibilities. Critical artefacts 'opened up' a broader space of possibilities and further (less provocative) artefacts were used to 'close down' to design ideas relevant to participants' lives and values. We hoped that the final design ideas would be more human-centred as they were resolved within a broader conceptualisation of social practices and technology rather than (prior to engagement with critical artefacts) narrow assumptions of 'what technology is *for*'.

The field studies and discussion of participants' own objects suggested (amongst other things) that digital mementos should be accessible, (re)discoverable and reflect the broad range of objects people choose to keep as mementos. The critical artefacts encouraged participants to reflect on alternative possibilities for digital mementos. Although they did not see *Aroma-mouse* and *Once upon a web* as specifically relevant to their needs (which was not the point), participants began to appreciate the potential of more general possibilities that they might not have previously considered, such as using traces of their 'digital lives' (e.g. web activity) as mementos and having tangible devices to prompt remembering. The discussions also developed our appreciation of what was of value to participants in their practices, such as affording personal time and space for remembering.

In the subsequent design work and discussions we developed ideas for digital mementos that both embodied these broader possibilities and reflected our understanding of what was relevant to participants' lives and values. E.g. *Txt Box* prompts 'personal memory moments' with saved text messages but is also relevant to everyday life (somewhere to dump your pockets' contents when arriving home).

The final design ideas embody our understanding, as researcher and designer, of features that human-centred digital memento devices and systems should have: being 'not like work', serendipitously discoverable and self-organising, and capturing a broad variety of digital material that might become mementos in time. But do they work as mementos?

Clearly not all digital material makes an effective memento. E.g. the workshop participants felt that most of their web activity was routine and boring and did not adequately represent significant past life experiences. However the selection of objects that can (or will) prompt reflection is a highly personal activity, sometimes long after the object's original function has ended. The problem with 'digital objects' is that they are fleeting and ephemeral. Our final design ideas demonstrate ways of retaining and materialising traces of people's digital lives that might otherwise be lost, from which they can create their own mementos.

5.3. Designing digital mementos with reflection

The fieldwork and design methods discussed above rely on a continual process of subjective interpretation. In the fieldwork, the participants' interpretation of the researcher's brief (to give a tour, to make a time capsule) and the researcher's interpretation of the gathered material. The designer's interpretation of the fieldwork (from the researcher) and the researcher's understanding of the context (from the design proposals). And in the design-led workshops, designer and participants interpret each other's experiences and ideas through the design of and engagement with artefacts.

This fits with an alternative view of knowledge production that (Boehner et al., 2007) have discussed as applying to the Cultural Probes approach (Gaver et al., 1999, 2004). In this view, knowledge is produced as part of an ongoing dialogical process between designers and participants. There is no objective process of refining a 'correct' understanding of people's experiences, as to do so denies the agency of both participants and designers in interpreting *any* understanding – each have their own subjective interpretations of the others' experiences and expectations.

Reflection is a key element within this subjective interpretation so the methods discussed here also describe designing *with* reflection: reflection as a mechanism for understanding the context and progressing the design activity (being central to how the critical artefacts were designed and employed). Our earlier work suggested that critical artefacts could encourage people to consider novel design possibilities (Bowen, 2007) and that these artefacts should be used in a particular manner with certain types of participants in order to develop useful insights for designing (Bowen, 2008). Applying the resulting critical artefact methodology in this study has enabled us to design ideas that are grounded in participants' needs and values whilst also proposing innovative uses of technology. However, this reflects one designer's practice with one group of participants. The ideation process depends on the designer facilitating a reflective dialogue with participants via what they design and how they attend to its discussion, which was not straightforward in this study and consequently other designers may find difficult. Further, needs and values recognised by these participants may not be entirely applicable to others.

The ideas for digital mementos we propose above (Section 4.3) are an embodiment of our understanding of what human needs and values such devices could support *at this point* in our research. They suggest directions for further design work refining these ideas into human-centred products and systems that a large proportion of people would recognise as being

relevant to their lives. The design of these digital mementos illustrates our tactic of using critical artefacts to prompt a reflective dialogue, but further work is required to determine how such methods could be utilised by other designers.

Finally there is another level of reflective dialogue, particular to mementos: people's ongoing re-interpretation of their memories via the objects and artefacts that they keep. Further study with working prototypes could suggest whether the digital mementos we propose mediate and afford such dialogues, which we intended in e.g. *Previously… Widget 2*. Instead, at this point we offer another desirable feature for digital mementos: that they should allow digital material to be appropriated for remembering (or forgetting) over time.

6. Conclusion

We have presented the notion of digital mementos as technology that affords reflection on personal experience (memories), discussed our work exploring user needs and human values in the context of autobiographical recollection and the design of digital memento devices and systems to support them. Our research and design produced ideas for devices and systems to afford remembering that participants felt were relevant to their lives and values (i.e. were human-centred) but were also innovative in suggesting novel practices and technological applications. Such methods could then be useful in designing other forms of personal reflection.

Throughout this work, reflection was a central mechanism for researcher, designer and participants to develop their understanding of what digital mementos *could* and *should* be. And the resulting design proposals, in reflecting a broader range of possibilities for human activity and applications of technology, themselves prompt reflection. Our digital mementos propose how people could remember today tomorrow but also provide a critique of how we remember yesterday today.

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