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Abstract The interdisciplinary Tales of Things and electronic Memory (TOTeM) project investigates new contexts for augmenting things with stories in the emerging culture of the Internet of Things (IoT). Tales of Things is a tagging system which, based on two-dimensional barcodes (also called Quick Response or QR codes) and Radio Frequency Identification (RFID) technology, enables the capturing and sharing of object stories and the physical linking to objects via read and writable tags. Within the context of our study, it has functioned as a technology probe which we employed with the aim to stimulate discussion and identify desire lines that point to novel design opportunities for the engagement with personal and social memories linked to everyday objects. In this paper, we discuss results from fieldwork with different community groups in the course of which seemingly any object could form the basis of a meaningful story and act as entry point into rich inherent 'networks of meaning'. Such networks of meaning are often solely accessible for the owner of an object and are at risk of getting lost as time goes by. We discuss the different discourses that are inherent in these object stories and provide avenues for making these memories and meaning networks accessible and shareable. This paper critically reflects on Tales of Things as an example of an augmented memory system and discusses possible wider implications for the design of related systems.

1 Introduction

Tales of Things and electronic Memory (TOTeM) is a three-year collaborative project between five universities in the United Kingdom. The project aim is to explore the implications of Internet of Things (IoT) technologies for the design of novel forms of augmented memory systems. While the potential implications of the IoT for supply chain management [1] and energy consumption [2] have been acknowledged and discussed, its application for the engagement with personal and social memories has been rarely mentioned. More and more newly manufactured objects are often tagged at production and made traceable. However, we typically do not think of old(er) objects as part of these networked structures. Our interdisciplinary research group in the Tales of Things project is interested in exploring the value of enabling an infrastructure for a user-generated Internet of Old Things that captures people's memories related to these objects. In TOTeM, we are employing tagging technologies such as Quick Response codes and Radio Frequency Identification (RFID) to provide links between objects and a centralized database of

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stories about these objects. The Tales of Things service makes these tags read and writable, so that events and memories can be captured and replayed to reveal the significance of the tagged object. In short, and to use populist terms, a framework as proposed by TOTeM could be viewed as a mix between a 'facebook of things' and the 'antiques roadshow for the future', whereby scanning an object replays its past, its associations, its locations and the memories of its owners. Consequently, the ability to tag, provide and embed objects with memory has potential to change the social and economic value of real-world objects.

In this article, we will start with an overview of the research background and related activities in the field. We will then provide an outline of the architecture and the scope of the Tales of Things service that was developed to support our work before we discuss two evaluation studies that the authors conducted and present the outcome of this work. We relate findings from our fieldwork to prior research and show opportunities and issues identified when using Tales of Things as a platform to capture personal and social memories. By personal memories we refer to specific events from one's past that are part of the autobiographical memory [3]. The use of the term social memories acknowledges that while some memories are strictly personal, others are often socially shared, for example, in communities with specific interests (e.g. all fans of a specific music band and stamp collectors) or with close friends and family [4]. In the TOTeM project, we are interested in exploring this design space that includes personal and social applications of engaging with memories. In the concluding discussion, we abstract implications from our work with Tales of Things into general design recommendations for augmented memory systems.

2 Background and related work

Human-centered memory technologies provide means to share past experiences and to engage with memories in ways that provide valuable opportunities for learning and development of new life perspectives [5]. Consequently, a number of augmented memory systems have been developed over the last two decades in different research projects. The design of augmented memory technologies is a multidisciplinary field [6], encompassing research in material studies, psychology, anthropology and human–computer interaction, and chiefly drawing on concepts of autobiographical memory. While we will refer in this overview to related systems, we do not intend to cover the entire field of memory technologies or specific applications, for example photoware; for a comprehensive overview of a broad range of augmented memory systems and their purpose, see [7].

The sharing of memories is an important cultural activity in which physical objects often play a significant role. It has been put forward that the objects with which we surround ourselves provoke thoughts and emotions [8], constitute part of our identity [9], act as cues in the process of remembering [10] and mediate our relationship to our memories, therefore acting as intermediaries between future and past [11]. A 'memento' is generally considered as 'an object given or deliberately kept as a reminder of a person, place or event' [12, p. 53]. Such objects typically have use-related functions but can also act as 'signs' with symbolic meaning, which can be 'interpreted in the context of past experiences' [13]. In the following, we discuss how digital memory technologies can make a valuable contribution to these processes through augmentation of objects with information interfaces.

Hoven and Eggen [7] put forth autobiographical memory theory and describe types and functions of autobiographical memory. The authors propose that constructivist theory can inform the design of memory augmentation systems, which see remembering as an active and selective process, which is different from lifelogging [14]. Hoven and Eggen [7] describe the conditions in which tangible objects can be useful as cues to mediate access to memories and different functions of autobiographical memory. Petrelli et al. [12] discuss as outcome of their studies the autotopography of mementos in people's homes and explore what types of objects people choose to keep as mementos and why. They describe the proposed autotopography and their approach as follows:

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 [12, p. 53].

The authors distinguish between personal, family and public spaces in which mementos are kept, and they propose a number of implications for design of digital memory technologies. These include, among others, the need for a straightforward access to augmented memories; the suggestion to enable interactions with tangible objects, not only with representational objects (e.g. photos or video); the search for new creative ways to create narratives and annotations linked to mementos as these are the ways in which people 'invest them with the relevant mnemonic meaning'; and an awareness for the fit of memories and living spaces, which suggest different forms of engagement with memories that range from personal use to sharing of memories depending on the social context.

Findings of the Living Memory Box project [15] equally highlight the value of storytelling and propose that digital memory technologies should enable 'the inclusion of

practically any object' (p. 215) in this process. In another study, a 'cultural probe' [16] was used to explore what kind of past experiences people would want to remember and why [17]. Petrelli et al. [17] report that the majority of the objects that people added to the cultural probes were either specifically collected or created for this purpose and that people rarely annotated their mementos. The authors report that participants mentioned they would find it interesting to figure out why they kept some of the mementos in the future, which suggests room for playfulness and creativity in memory technologies. However, it has been reported that lack of annotations can be problematic in the long run as their value increases as time goes by [18]. Petrelli et al. [17] recommend that digital memory technologies ought to support creativity, active selection processes and the discovery of meaningful connections. Related research in people's homes has also revealed that mementos often give way to rich storytelling in the inquiry of why people keep memorabilia [19]. The importance of storytelling in relation to memories is therefore reiterated and of specific interest in this context.

It has been proposed that 'humans are storytelling organisms who, individually and socially, lead storied lives' [20, p. 2]. Hence, narrative plays a key role in the process of human meaning-making and in the structuring of life experiences [21, 22]. van Dijck [11] argues that only when our experiences are transformed into stories do we gain agency of our past. Consequently, creating and engaging with stories is part of our everyday lives and is also the foremost way in which we inscribe, alter and access memories. While the importance of integrating opportunities for storytelling into digital memory technologies is widely acknowledged, there are fewer examples that discuss the value of different media for augmented memory systems. Notable exceptions to this are recent publications on the use of sonic mementos. Sonic Gems [23] and FM Radio [24] are prototype systems that use the audio medium to record and engage with memories. Research studies with prototypes in both projects propose that audio is an engaging and promising medium for augmented memory systems. FM Radio enables the integration of different sonic mementos into a familiar radio object but does not provide direct links to physical artifacts [6]. The sonic gems prototype uses RFID tags that link sonic memories to objects and which are triggered when an object is put into a bowl that has an RFID reader attached to it [23]. Other examples of projects that make use of RFID technology to augment objects with information are the Memory Stone [25], SOUVENIRS [19] and Rosebud [26]. Hoven and Eggen [7] provide a summary and overview of different augmented memory systems, the media these systems support, and their links to physical artifacts as cues for remembering.

3 Tales of Things

Tales of Things[1] is a tagging service that enables people to record multimedia stories (tales) about objects (things), and it provides means to link these stories to objects via QR codes and RFID tags. The system consists of multiple interfaces (web browser, mobile clients for the iOS and Android platforms, bespoke RFID readers) to enable the creation and sharing of stories about objects. In this context, a thing can be any object people wish to add to the Tales of Things database. Examples of things in our database include everyday objects, such as coffee mugs, clothes, photographs, gadgets, artwork and furniture, but also buildings, places and spaces. The 'things' that are part of our system can be tagged with RFID tags or two-dimensional barcodes (QR code or Quick Response codes), which act as unique identifiers to access the history of an object and, if permitted, add to an object's provenance information. Hence, these read and writable tags provide a link between objects in the real world and information space. The scanning of tags with our mobile clients allows the playback and adding of object-related stories. These interactions of people with objects generate provenance information and provide novel ways for engaging with past experiences. As such, the system allows for a user-generated 'network of things with stories' to emerge. While not all object stories necessarily directly have to describe memories, they lead to the creation of a human interaction history with an object and might well be considered as memories in a generic sense. Hence, when we discuss stories in this paper, we make the implicit assumption and simplification that these stories are memories. Figure 1 shows a screenshot of the web view of an object story on Tales of Things.

Conceptually, the main entities of the system are things and tales. When people add a new thing via their mobiles or using the web interface, they are asked to provide at least a name, description, status (public or private) and keywords for a thing. Optionally, people can provide additional meta-information, such as year of ownership, year of creation, a photo and, via the linked tales, information about the location of a thing. Mandatory elements of a tale are a title, a textual story and related keywords. Optional elements of a tale include a location and a list of media URLs. We decided to make some elements for things and tales mandatory to encourage useful annotations, which might be crucial to the reconstruction and interpretation of memories over time [17, 18].

Apart from the image that represents the object, Tales of Things does not store any media files on its server. Media are integrated as links to web resources. Media from Flickr,

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[1] http://www.talesofthings.com.

Fig. 1 Web view tales of things

YouTube (see Fig. 1) and Audioboo are rendered in an integrated media player interface on the website. All other media references are rendered as clickable links. The discussion in the previous section outlined that there is a need to enable storytelling in memory technologies. As a consequence, Tales of Things supports various media in the process of creating and accessing tales. People can create tales by using text and media files, including video, audio and images from social media hosting sites. This provides opportunities for creative storytelling to inscribe personal memories that are linked to (old) objects of significant personal meaning.

For every new thing that has been added, a unique two-dimensional barcode (QR code) that points to a unique URL (Uniform Resource Locator) on our server is created. This code can subsequently be printed and attached to the thing. When a Tales of Things QR code is scanned via our custom clients, the history of stories and interactions with the object is revealed. Figure 2 shows the enabling sequence of steps in our mobile client (an iOS client in this case) for accessing this information and for adding a new story (writing back to the tag). Since our QR codes point to a public URL, generic QR code readers can launch the public view of the resource in a web browser. However, additional functions to add new tales to the object history require a Tales of Things specific client application. It is worth mentioning that people also can use the Tales of Things website to scan tags via their webcam that will also reveal the interaction history of the object. This has been implemented to enable access for people that have no smartphone. This was important for some of the community groups we worked with, as smartphones were not in widespread use in these groups.

Tales of Things aims to encourage social networking around common interests through the provision of groups (for shared collections of objects), a commenting system and notifications of activities (e.g. when someone adds a new tale to one's own object), as well as through links to social software and networking sites, such as Facebook and Twitter. The public web view of a thing contains embedded meta-information in RDF (Resource Description Framework) and Open Graph Protocol format that can be

Fig. 2 Interaction sequence mobile client

analyzed by search engines and third party services with the aim of making the data available through integration in semantic web applications. Additionally, the website provides a search function and different content views (e.g. location of things, recent activity and tales most commented upon). Participants can chose whether they want to keep their object stories private, or whether they want to share them with other users they invite or whether they make them publicly available.

The Tales of Things service was launched in April 2010. Use of the website and bespoke mobile clients is free of charge. We developed an Application Programming Interface (API) that enables third party applications to query the service as several thousand objects have already been added to our database. For a detailed description of the technical implementation and a discussion of how the QR codes are generated, see [27].

Tales of Things functions as a technology probe [28] that helps us explore people's needs and desires in real-world settings at the same time as stimulating dialog between researchers and participants about tagging technologies and memory technologies in particular. As such, Tales of Things has partly been employed to identify desire lines [29] of use that can provide specific design opportunities and lead to a refinement of the initial service. The concept of desire lines derives from urban planning. A desire line has been described as 'a worn path showing where people naturally walk', and as an expression of human desire [30, p. 293]. The concept has successfully been applied to the design of ubiquitous computing experiences and implies that initially few constraints are provided on how people use a technology and that new constraints to a design are subsequently added based on an analysis of observations of people's interactions with a system or service [31]. We see desire lines as a useful way to explore behaviors of people from diverse user and community groups.

4 Fieldwork

As part of TOTeM's aim to study the social applications and implications of Tales of Things in a variety of community contexts, we have been keen to involve people who could be considered less likely to be early adopters of either the website or the tagging technology. These have included representatives from older generations, diasporic communities, people with disabilities or memory problems, and members of lower-income households. Where possible, recruitment took the path of linking in with existing community groups and activities. For instance, we worked with the European Reminiscence Network during a week-long workshop, which saw older participants from different European countries use personal objects to build memory boxes in the process of reflecting about their working pasts and futures. We also facilitated a Black History Month exhibition of tagged objects donated by Black, Asian and ethnic minority groups in the London Borough of Greenwich by collecting and sharing object stories from group representatives. In the following, we discuss two such case studies in more detail, identifying some of the objects and discourses (stories, memories and 'everyday personal narratives' [32]) that were made relevant by participants. A second line of inquiry is based on a focus group pilot, which explored the general desirability of the Tales of Things service for one group of older people.

4.1 Emerging themes and discourses in digital object memories

Our research encounters have generally involved a combination of participant observation and the video recording, editing and uploading of object stories, largely facilitated by the researchers but, as far as possible, 'directed' and reviewed by participants. Video was chosen as a particularly rich and communicative mode of story sharing.

Beyond this, it was essential to us that people told us about the things that meant something to them personally and that they did so in their own words and on their terms (e.g. by allowing people to choose the extent to which they wanted to be seen on camera, if at all). The partly opportunistic nature of our community engagement means that case studies need to be understood within the specific contexts in which they occurred (elsewhere, we reflect on the research process; see, for example, [33]). At the same time, it is possible to identify some emerging patterns in stories across sites.

In the following, we discuss materials gathered during two small-scale case studies, both conducted in the London Borough of Hillingdon between July and October 2010. The first took place in a Hillingdon library where participants were introduced to the project during one of the library's regular coffee mornings. They were invited to come along with their objects at any time during four recording days. A total of thirteen general object stories from twelve, mainly older participants, were recorded during the initial library study. Participants were personally visible in five recordings; the remaining tales framed individuals' objects.

The second case study developed through a contact made during the library sessions and involved a group of visually impaired people from the area who invited us to one of their monthly meetings in September 2010. Ten participants, nine of whom were visually impaired, took it in turns to share a total of fifteen object stories with us and the group. This group was again dominated by older participants (55+). Since it was not always possible for members of this group to review the visual features of a video recording, we opted to focus entirely on filming the objects, with participants narrating their stories as voiceovers.

In both case studies, the diversity of objects was intriguing. Although there were, 'objectively' speaking, recurrent categories of things (e.g. photographs, kitchen utensils, ornaments, musical instruments and stuffed animals), it seemed that virtually any kind of object could form the basis of a story. In the library study, for instance, items included a biscuit tin, a dictionary, a Davy lamp (mining lamp) and (photos of) a Boudoir grand piano. The group of visually impaired people brought, among other things, a piece of shrapnel, an MBE (a medal awarded by the Queen), a horseshoe, a button hook, an alarm clock and a clothes hanger with tailor's chalk. Objects differed in terms of whether they were new or old; crafted, bought, inherited or given; representational, symbolic [17] or functional (i.e. still in use); and whether they related to one's own life and personal experience or more to those of other people. Of course these characteristics could overlap as in the case of the pie funnel (library study), which was at once linked to a personal memory, identified as a 'symbol of the family', and is still in use by its owner today. Figure 3 shows some of the objects that participants brought along.

In one of the most comprehensive studies of personally meaningful domestic objects, The Meaning of Things [13], Csikszentmihalyi and Rochberg-Halton note the enormous flexibility with which meanings can be ascribed to objects (p. 79), and they generally emphasize the importance of kinship, that is, of objects as evoking and reinforcing 'social ties […] that provide continuity in one's life and across generations' (p. 86). The majority of the tales gathered during the present case studies can be described as relating to what the authors classify as mementos, that is, to things that are meaningful because they hold, evoke or stand for certain personal memories (p. 270f). A typical example of this, and one that (equally commonly) relates to immediate family, is a stone hot-water bottle that was brought into the library by one older participant:

> This… is my memory object… […] It goes back to my very early childhood, I have no idea how old it is, but it's way before, before the 1930s. And my memory of this is my grandmother… wrapping… this object in a towel… it…, having been filled with hot water, of course, and putting it into my bed, as a little girl, to keep my feet warm… Erm, my grandmother was a very loving person and took great care of me, and…I have great memories of her.

It was notable that, while all objects had a certain personal significance, such as the one above, they were also at times chosen because they were potentially of interest to other people. Not evident in the above tale is the fact that the participant treated the stone hot-water bottle as somewhat of a mystery object, making us guess what it was before relating her tale. In the case of some objects, the 'novelty' factor of the item clearly took precedence over the (still implied) personal significance:

> This is a 50-… or 55-year-old button hook, which people don't have nowadays, but when she was little, my sister couldn't fasten her shoes, which were fastened with buttons, so she had…, she took that to school, cos [amused] she had nobody to help her fasten her shoes after PE… So, I don't know if there's anything on it… or not, if it's just plain… [Researcher: 'Just plain.'] But that's just a button hook, I just thought might be interesting… cos I don't suppose you see them now, [quickly] they had them in Victorian times, too, for fastening boots.

A tale, which perhaps most strongly exemplifies the link between personal memories, family histories and wider historical significance, is a younger participant's story

Fig. 3 Participants objects on which stories were based

behind a set of photographs that she had unearthed in the library archive. The photos show her great-great-grandfather (1817–1857), a local town crier, whose own biography was full of trials and trepidations and whose son went on to found two local newspapers (both of which are still in existence today). This woman's tale was as much one of family genealogy and personal discovery as it was a tale of local history. As the final part of the above button hook tale begins to illustrate, certain objects also lent themselves to the sharing of expert discourses. The acquisition history of the following object renders it personal (it was passed on from the owner's father's generation), but the expert discourse dominates:

> And this pocket watch is special for… people in industry. It's… tells the time in a normal way… but also it's… combines with a stop watch. And on the stop watch not only has it got the seconds around the dial, but also […] figures which… are used for people who used to work with piecework. […] But that was… dates, dated around about the 1900s odd, when piecework was introduced by… the Ford Motor Company in America, and… they utilized what was known as the [Beddoe??] system… which… was a form of paying the workers by the number of parts that they could produce in a certain length of time.

There were some structural differences between object stories as they were gathered in the two research settings. Specifically, while the first case study tended to produce pieces to (or behind) the camera where the main conversation partner were the researchers as well as, importantly, unknown internet audiences, stories generated in the group context clearly sought to provoke direct responses from listeners. In addition, the stories produced by the visually impaired group of participants contained more descriptions of objects, which were deemed less relevant by participants in the library context most of whom were not visually impaired. The group also initiated the passing around and

tactile exploration of objects at different stages of the tale-telling. Yet, besides the above structural differences, there were significant similarities between participants' stories across both groups, and these mainly related to the ways in which objects were routed in time and space, and in relation to other people and objects. A good example of this is the story behind a wooden elephant:

> 'Right, this is a little wooden elephant… and it's one of a pair. And it's been with me ever since I was born… Erm… now, it's got no tusks, and I can't ever [laughing] remember it having tusks, I think they were broken quite early on… Erm, it came from India… during the war. Erm… my dad was born in… err, 1908, so he was, erm… 31 at the outbreak of war. And he worked for Wall's ice cream. And they… then changed it to margarine, so th'…, he was considered to be in a reserved occupation… But…[laughs] dad being dad, he joined up and joined the Royal Navy. And he was…, he… actually went to be a petty officer in the end. He got promoted. And erm… this little… fellow came from India… and erm…—[referring to another member of the group] the gentleman was talking about medals: dad had his medals. And he had a Burma Star. But he never ever discussed the war. And erm, on Armistice Day, he had a little, erm… lapel badge, which had the initials 'MS', cos he actually was on Minesweepers… which was quite dangerous, I believe. And so, as I say, my job as a child was to polish these two little…[laughs] elephants, they were on the sideboard…and erm, so, as I say, they've been with me ever since I was born… and that's why I love them.'

As with previous examples, this object memory can be described as revealing what are often implicit and untold 'networks of meaning' [13, p. 87; 33]. In the case of the wooden elephant, meaningful links are made with other people (immediate family) and their biographies, historical

events (World War II) or more general times in history, locations (India), organizations of 'working life' (Wall's ice cream), places in the home (sideboard) and other objects (the second in the pair of elephants, the Burma Star, the lapel badge, Minesweepers).

Finally, again presumably due to the element of sharing and preserving tales online, object stories in these case studies can be seen to display different kinds of discursive and symbolic orientations. The following list may not be exhaustive and is based on a small number of stories, but it helps to inform the design of augmented memory technologies, illustrating that stories were constructed to be shared with others. There are the aforementioned expert discourses, which could be linked to different pieces of information and may attract specific audiences (peers, amateur historian and educators). Participants also told mystical or morality tales that fulfilled a more performative function and seemed geared toward other audiences. The former implied uncanny properties as objects were presented as intrinsically linked to a person's fate or rite of passage; the latter were object stories that carried some sort of life lessons or sharable wisdom. Finally, there were, as mentioned above, different kinds of biographical narratives—namely stories referring to individuals' biographies, those of other people or, importantly, those of objects. As well as being tied up with people's biographies and life stories [34], these objects are considered to have their own life cycles [35, 36; see also 37] and can be put on view as such in a wider 'internet of old things'.

4.2 Focus group study

The previous section focused on the kinds of stories and memories participants wanted to share with us and the online public through video tales in two research settings. In October 2010, members of the research team also conducted a small-scale evaluative study of older people's subjective experiences with the project website, talesofthings.com. The main aims of this trial were to address issues of usability and accessibility and to test possible user scenarios. Two male and four female participants in their 50s, 60s and early 70s took part in an afternoon session, which was divided into two main parts. First, respondents were given a handout to independently navigate the project website and operate a number of basic website functions, such as adding 'things' and 'tales', printing QR codes, and searching for particular objects and stories. Each participant had brought along two personally meaningful objects to the session and was asked to draw on related memories and stories during this otherwise rather mechanical task. The handout allowed them to note down initial impressions of the website as they completed each step. It also contained a small open-ended questionnaire about general

internet uses and competencies and was followed by an adapted version of the Microsoft 'desirability toolkit' [38], which sought to identify kinds of enjoyment or displeasure in people's interaction with the site.

The second part of the afternoon was devoted to a group discussion during which participants talked about their experiences with the site, shared personal object stories with each other, and evaluated how, if at all, Tales of Things could be useful and relevant to them as individuals. Despite our central interest in website evaluations and subjective user experiences (which have been taken into account in our activities and will be discussed elsewhere), we used this pilot session as an opportunity to also explore other issues regarding the objects' places in participants' homes and lives, and the relationships between objects and memories. We think some of the considerations emerging from this discussion are relevant here. They regard people's understanding of the project and website, the perceived value and legitimacy of sharing personal histories, and the tensions between the private and public realms of memory. The conversation moved reasonably quickly from an initial incredulousness regarding the purposes of the site and project toward imagining possible use cases.

For example, participants discussed the potential of employing Tales of Things to share stories or memories with one's children in a format that is accessible to them and that they can use in their own time as and when they are interested or 'ready'. To a degree, this was a contentious issue:

B6: … I think I'd like to use it for my sons… Because I think sometimes you…, it's difficult communicating with… children, especially boys who… don't tend to talk or want to listen about… your stories
B2: … No, they don't. [laughs]
B6: … or things that have happened, and I think it's a way of, erm, capturing that information for when they're ready… to look at things, and they feel comfortable
[…]
B4: Yeah, but that's sort of writing… something about the self or… or what your personal…, and then saying to your sons… switch the computer on, and then you can, you can read about it
[laughter, B6 nodding]
B6: Yeah but that's wh'…, wh'…, that's what happens with Facebook!
B2: Yes, yeah, yes
B6: … My sons talk to me through Facebook more
B4: … yeah, yeah
B6: … than they phone me up now, cos they're more comfortable with texting and typing and… than they are holding a phone in their hand

B4: … Hm
B6: … talking to me

While others were clearly taken aback by this scenario, arguing they preferred speaking to human beings in person, they agreed that mediated contact to one's children was better than none. Objects played a role in this scenario but seemed to function as entry points into what really were stories about a person's past or family history. Incidentally, Facebook and Twitter were repeatedly mentioned in the group's talk about Tales of Things, especially by one female participant who grew particularly enthusiastic about the project's online platform:

> B4: I've got time to… I…, perhaps I have a lot of time on my hands all day, living on my own, so I've got time to… to do it. Perhaps just… sometimes I wake up in the night, can't sleep, so I might think— oh, I'll just go onto that and just read… about… somebody. […] Yeah, I'm a bit fascinated now… I…, it…, cos it's just something else… like, you know, like Twitter or Facebook, it's just another little thing now that I can go on… to do, so I'm, I'm a little bit fascinated… with it.

This participant also liked the succinctness of most stories on talesofthings.com, since they satisfied her curiosity about the lives of other people while complementing her relatively short attention span. This was clearly an issue of personal preference, as one other participant countered she would always choose reading a good book over surfing talesofthings.com or Twitter. Nevertheless, the nature and formats of stories on talesofthings.com—participants referred to both videos and written texts here—further led to reflections about possible applications in educational settings (primary school) or practices of reminiscence in dementia care. This was especially the case since the site offered visual associations with objects and stories. Moreover, the very act of recording or writing down an object story was considered beneficial for one's memory and somewhat therapeutic in its own right.

While participants could imagine documenting their general life stories and attaching objects where relevant to the grand narrative (B6: 'So if you worked […] in the pottery industry… you could attach a vase […] or tea cup.'), the sole idea of recording or writing up stories of objects and sharing these online with others was clearly not something any of them would have entertained ('in a million years') before encountering Tales of Things. Partly, our introduction to the project opened this up as a genuine possibility: individuals liked the idea of putting certain things about themselves out there for others to see (B4: 'it's just somebody's perhaps interested in what I'm doing, which is this similar… type of thing [as following someone on Twitter]! Someone is interested about… somebody else's… memories'); respondents also discussed the notion that, if they passed away or their physical objects got lost, their stories and objects would still be 'out there', in cyberspace.

However, not all members of the group were convinced. One main tension related to the value and appropriateness of sharing personal object stories online. There was a sense that certain memories behind objects were intrinsically personal and idiosyncratic, only meaningful to the individual and, thus, of no real interest to others. At the same time, these convictions, though still contemplated, broke down in the very process of telling and listening to others' stories in the room and in reflecting on the experience of watching or reading stories online; both were generally deemed enjoyable, entertaining, amusing, informative, even educational, mostly because they drew on contextual pieces of information which went beyond personal memories and connections.

One respondent, for instance, told the story of his father's watch and reduced the group to laughter by painting an amusing picture of his grandmother 'smuggling' the watch on a ferryboat from Southern to Northern Ireland in the 1950s, with contextual information and a partial re-enactment of the scene adding to comic effect. Another respondent spoke of the multitude of personal memories and stories evoked by a whistle that originally belonged to an uncle, an army officer in the Second World War, but the significance of which reached from her grandfather who died in 1900, via the role of women in society during the first half of the century, to the revelation of a family secret. Incidentally, this respondent also pointed out that she would not hold on to objects for mere sentimental reasons, but because she has use for them in her daily life (as a keen walker, she carries the heirloom with her as an emergency whistle).

What finally emerged from the discussion was that the sharing of personal object stories was more legitimate when they more readily took on an historical significance, either because personal anecdotes also shed light on wider historical contexts, or because enough time had passed for them to fall into that category. The following exchange illustrates much of these kinds of thought processes:

> B3: […] well, it's of interest to me, but I can't really see anybody else getting… any joy out of reading… the memory of my watch or […] an ostrich's egg, except for the tears that it brought to the poor ostrich's eye, erm… [group laughter]… but… it, it's personal to me, and it's nice to… to actually write it down, rather than just… keep it in your head, because…[group agreement]…you know, one day
> B6: … it could be personal to your family, though, yeah, [B3]

B2: … it is

B3: … you'll die or…, [circulates hands around head] you know, you know

 [group agreement]

B6: It could be personal to your children, though

B3: Erm

B6: … That's what I'm trying to say

B3: … [Hardly??]… err, well, it, it might be… in many years to come

B6: … Yeah

B3: Now they'd s'… [reads off his hand, quietly] 'stupid old fool'!… [group laughter]… But because, you know—'why has he put that on there for? I didn't know that!' […] Well, it's there for when you want to know

B6: Yeah, that's what my point […] was with my sons really

B3: … but then… […]

B1: … But giving it a few years

B3: … you know, I could if I had the time, I could sit'n

B1: … they will want to know

B3: … write… the memory of my life, as I see it… print it off and say—read that, stop talking to me, just read it, and then you'll… know all about it

Due to the initial set-up of the session, much discussion centered on the potential and implications of talesofthings.com, rather than on its tagging applications. Having said that the significance of the latter as enabling the link from treasured object to (perhaps by then historical) story was gradually understood and valued. Although this was very much a pilot focus group, largely designed for different purposes, the discussion mirrors views we have encountered in other contexts where people found Tales of Things 'an interesting way [to] keep people's memory and associate people via objects across [the] physical and digital world'; while they 'wouldn't want to put highly personal objects/stories into a completely public space', they could envisage Tales of Things as 'a great mediating tool within family or friendship group'.[2]

Based on wider fieldwork conducted over the period of a year, the project clearly evokes in participants the potential for intergenerational exchange, both in the present (enhanced by social interaction opportunities on the site) and in people's visions of sharing tales with future generations. Although there are privacy concerns that need to be reflected in future design, the kinds of stories older participants wanted to share, the purposes they could envisage in Tales of Things and the personal and wider socio-historical memories and references captured in object tales all

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[2] Feedback from participants of a digital hub workshop in Nottingham in which Tales of Things was explored.

suggest that the project may entice user groups for whom the Internet and other 'new' technologies have thus far lacked personal relevance [39]. Researchers have begun to explore the benefits of online videos as motivators for intergenerational exchange [40]. While many social networking sites and other new media technologies are still largely constructed for peer-to-peer interaction [41], Tales of Things can cater for older people's 'ongoing need for meaningful social interactions and for intimate reflection on the meaning of one's life in relation to others' [41, p. 19].

5 Conclusion

Our fieldwork and the analysis of user-generated content on talesofthings.com provide insights and pointers into yet unexplored design opportunities for supporting interactions with personal and social memories through the creation of object stories and their linking to physical artefacts. The discussion has, among other things, covered aspects of why participants selected objects the stories of which they wished to share, how the discourse of object stories was structured and what kinds of relationships were expressed in these stories. Based on our fieldwork with a technology probe, a number of desire lines emerged that we wish to discuss here in more detail. Specifically, we see design opportunities for the application of Tales of Things to support the explication of networks of meaning, intergenerational communication and to mediate contexts for the exchange of objects. We have shown that, for the participants in our case studies, literally any object could potentially become a source for a story of significance for their owner. The ability to tag any object and to involve these in the storytelling process is thus important for an augmented memory system. We found that linking stories to objects is generally well supported in Tales of Things. We are aware that not everybody has yet access or the affinity to use smartphones to scan tags, so that we aim to explore other avenues for capturing object stories. It is worth mentioning that while we have mainly focused on the use of QR codes and RFID tags, the system is independent of the kind of tags that are used and additional types of tags (e.g. images) can be used in the future with relative ease.

The object stories that people created gave way to rich and complex networks of meaning that often involved references to genealogy, social histories and information about times and places. These networks of meaning are often inaccessible to others and hence remain unexplicated. An augmented memory system like Tales of Things provides opportunities to explicate and share these networks of meaning with relatives, friends or a wider public audience. The discussion with participants uncovered that this

sharing of information that is inherent in these object stories was frequently perceived as valuable. The older generation of participants we engaged with specifically saw potential in using augmented memory technologies for intergenerational communication in their families, for example, as heirlooms.

Apart from sharing these object stories in families, participants also perceived Tales of Things as a means to reach a broader audience that is interested in the things they have to share. It has been proposed that the meaning of events develops as time goes by through 'reflection, sharing and comparing with other experiences' [3]. Tales of Things enables this sharing which can trigger such reflection by providing a platform for discussing object memories. The availability of semantic descriptions of the data and the availability of an API enable the exploration and accessibility of these networks of meaning outside the boundaries of the application we have developed. This ensures that the communication can be continued elsewhere. As a consequence, personal memories can be shared in novel ways. However, there is still more work to be done to understand how these distributed networks of meaning that people create can later be interacted with and shared in physical spaces. In order to assess these implications, we will create a *memory palace,* a place that signposts its social and historical significance through tagged objects, that we will equip with accessible interfaces for accessing and adding object stories. Access to object stories in situ also adds a new dimension of perception that can alter the contexts in which objects are exchanged. In ongoing fieldwork, we are specifically exploring the charity shop as a setting for the evaluation of augmented memory technologies[3] and will report about this line of research in future publications.

As we discussed earlier, it is desirable to encourage rich storytelling in augmented memory systems. Our discussion of related work has also pointed to the relevance of having sufficient contextual information and meta-information, which support interpretation and recollection of the events that are associated with mementos. Rich storytelling can provide this aforementioned context and is thus crucial to the usefulness of a system like Tales of Things. From a design perspective, the question is how we can encourage people to create and share these rich stories and also leverage settings that lend themselves to storytelling. Our observations during fieldwork showed that people like to engage with tales that had integrated media and that object stories that made use of video and audio often caught the attention of participants. The stories we discussed in this publication were largely facilitated by researchers through the recording of video and audio during fieldwork. This is obviously not a scalable model, and, consequently, additional and more autonomous ways of capturing objects stories need to be promoted. Moreover, we are looking to incorporate additional interfaces for storytelling in Tales of Things to lower the entry barrier for exploration of the system. For some user groups, such as visually impaired people, web and mobile interfaces score low on accessibility. In the next cycle of the project, we will, therefore, explore how we can encourage the creation of object stories in different social contexts based on ubicomp technologies. Therefore, we wish to explore the design of additional tangible interfaces for storytelling. An example of this is the possible use of a custom audio recording device that enables visually impaired people to create and access audio stories. Like researchers in related projects [23, 24], we found audio to be a powerful medium for sharing memories in a pilot study [27].

Finally, a project like Tales of Things necessarily has to adopt a long-term perspective as the kind of provenance information that is generated typically becomes more useful as time goes by. The adoption of the long-term perspective is reflected in our participation in standardization activities to define object memory formats with the aim to make memories that are recorded via Tales of Things transferable between different systems.[4] Such an investment in the design of a meta-framework for describing the format of object memories might bear fruit in the long run as it leads to an increased sustainability of system design efforts. In future research, the TOTeM team plans to extend trials. At the time of writing, we are in the process of setting up case studies in a range of charity shops across the UK. Starting in Autumn 2011, longitudinal data will be collected across a number of sites. We aim to integrate audio- and video-based storytelling devices in these settings, so that individual trial sites become closer to the memory palaces we envision. These inquiries will allow us to explore how people use the service for an extended period of time and evaluate its usefulness and desirability that can lead to the refinement of the system with the aim to elicit further design requirements for augmented memory systems in general. We will continue working with diverse community groups in this process and critically evaluate whether and under which circumstances an Internet of old Things can add value to participants' everyday lives. However, the results of our research so far indicate that such systems when carefully designed can be useful and valuable for reminiscing, the creation of social histories of families and communities, and for social interaction.

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[3] http://fields.eca.ac.uk/totem/?p=786;
http://news.bbc.co.uk/local/manchester/hi/people_and_places/newsid_8680000/8680310.stm.

[4] http://www.w3.org/2005/Incubator/omm/.

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