

User Needs and Design Guidelines for Mobile Services for Sharing Digital Life Memories

Thomas Olsson, Hannu Soronen, Kaisa Väänänen-Vainio-Mattila

Human-Centered Technology, Tampere University of Technology

P.O. Box 589, FIN-33101 Tampere, Finland

{firstname.surname@tut.fi}

ABSTRACT

Digital media content can contain items that are very personal and valuable for their owner. Such items can form *life memories*, such as media collages from happy events or recordings of the first steps of one's children. Memories can be evoked and created "anytime, anyplace", and thus mobility is a key factor in managing them. Even though related systems for sharing photographs exist, users' needs for managing personal content have not been investigated specifically from the viewpoint of life memories. This paper describes our empirical research on users' needs for sharing the digital representations of their life memories. As the main contribution, we present design guidelines for services for sharing digital life memories. Furthermore, we present a mobile service prototype which was designed based on the guidelines. Our research shows that the creation, sharing, managing and viewing of digital life memories is highly based on meaningful real-life events.

Categories and Subject Descriptors

H.5.2 User Interfaces: User-Centered Design, Evaluation. H.3.5 Online Information Services: Data sharing. H5.m. Information interfaces and presentation: Miscellaneous.

General Terms

Design, Human Factors

Keywords

User needs, digital life memories, mobile services, personal content management, user-centered design, design guidelines

1. INTRODUCTION

With the recent growth of online services for sharing multimedia content it has become possible to share and enjoy personal content using mobile devices and Internet [1]. Such content can contain items that are very personal and valuable in nature and support management of users' *life memories*, such as memories from happy events or the first steps of one's children. Saving personal memories is a universal, fundamentally human

phenomenon. People appreciate recollection of past events and certain milestones of their lives. Sharing of common memories strengthens social ties and bonding. As life memories can inherently happen "anytime, anywhere", mobility is a central factor in management of life memories. Yet, not much is known about how life memories could be transformed into an electronic service. Furthermore, more understanding is needed of the levels of sharing: what are the life memories like and with whom are the personal memories shared. To design successful services for this purpose, it is important to understand what people's needs for managing and sharing life memories are, and the current behavior with related activities. Furthermore, design principles must be formed to support user-centered design of such services.

Many memory artifacts are visual: printed and digital photos, and home videos. In addition to photos and videos, people often collect physical mementos, such as tickets from a concert, children's artwork and seashells from the beach. Yet, sharing the memories has mostly been face to face sharing of photos complemented with verbal stories. However, merely a photo or a video is not always enough to describe the memory in enough detail, but also hints of the physical, social and emotional context are needed. The digital version of a memory could thus become enriched by context-related metadata [2], such as presence of people, location information, sounds and emotions. We define a life memory as *a digital media entity which is a multimedia representation of the actual memory and meaningful to its user. A (digital) life memory may be enriched with contextual information, i.e. metadata.*

Recently, new practices on sharing personal content have emerged with the rapid growth of online sharing services, such as Flickr [3] and Facebook [4], which provide tools for sharing content quickly after creation. However, these services offer very limited possibilities to merge, enrich and annotate the content while mobile. Flickr [3] is one of the most used online services for sharing photos with almost one Billion photos stored. At the same time, mobile phones have become versatile devices for capturing both visual and auditory data. Recently, it has become possible to collect and use also location and proximity related data with mobile phones. Overall, mobile devices offer tools for the entire sequence from capturing the content to sharing and organizing it.

In this paper we extend the approach of studying mere photowork or other single media content items with research focusing on sharing the very personal digital content artifacts that constitute life memories. Using various qualitative research methods, our empirical research focused on user needs and behavior related to managing life memories. Altogether 90 users participated in the study. Based on the results, we formed design guidelines for services for sharing life memories. Using the guidelines we

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designed a prototype service for sharing life memories. Finally, we run a series of iterative user tests to evaluate the usability and acceptance of the designed mobile service prototype.

2. RELATED WORK

There has been research on capturing and sharing various kinds of digital memories (see e.g. [5,6,7,8]). These studies mostly focus on exploring various technologies as tools for creating content that support the memories of humans (for example, by using highly advanced memory aids or utilizing constant recordings for both leisure and utility needs). Czerwinski et al. [5] describe various challenges related to managing of digital content: for example identifying valuable or important portions of our personal records, and sharing this information in a way that makes sense in the face of changing needs. Battarbee & Koskinen [9] state that people communicate their experiences to others if they see them relevant to the recipients. Often, this creates reciprocal activity where similar past experiences are discussed and elaborated. However, these studies do not directly address the users' needs in creating, sharing and managing digital *life memories*, such as meaningful sets of media content from a happy event.

Most of the personal content related research focuses on studying visual content (photos, videos) and its usage either in a mobile or PC context (see e.g. [10,11,12,13,14,15]). These studies reveal interesting aspects of tasks with various kinds of traditional content. Previous studies of mobile photography (e.g. "photowork") have disclosed the prevailing universal need for both capturing memories and sharing them with close people, see e.g. [7,10,12]. Camera phone photos are taken for, for example, maintaining social relationships, developing a personal and/or group memory, self-expression and functional (memory aid) purposes [10].

Sharing in the PC platform – often as public sharing by using the services in the Internet – is usually abundant and the recipient groups become large. On the other hand, although being instant, mobile sharing is limited to sharing only the most interesting recordings with only few people [10,12]. The sharing behavior is thus highly defined by the platform and its services.

Salovaara et al. [17] described a study of camera phone usage in a group of co-located users in a common event. In this context, explicit collective behavior could be found in both creating and using the created content. Salovaara et al. also found out that collective usage of content is rewarding because of its new interpersonal and inter-group communication forms and the novel ways of using the shared content. This behavior can be seen as a way to jointly constitute memories in common events.

A study by Kirk [14] showed that the most intensive photo editing is performed just prior to sharing. This emphasizes the significance of sharing: users want to share only their best photos, especially when sharing publicly. The quality standards and requirements of a sharable image depend on the recipients. The technical quality is not the only aspect, but also the artistic and informative quality and interestingness [10].

The usage of Flickr [3] has been studied rather extensively. A recent study by Van House [11] shows that Flickr is primarily regarded as a sharing place, not merely a storage service. Most photo content is social: friends, parties, togetherness, etc. Moreover, most users' photos were addressed to people the users

know, and even more specifically to the people at the photos or present at the capturing event. Elements of self-expression and presentation could also be seen in some users' shared photos, but not as strongly as the social aspects.

Regarding the levels of sharing, Miller & Edvards [13] concluded that most Flickr users share their photos publicly although the initial idea was to share only with a selected set of users. The study points out various aspects of sharing photos in Flickr, for example the general free attitude against sharing photos publicly. Miller & Edvards introduced the user group of *Snaprs*, who regard sharing photos rather liberally: almost any kinds of photos are shared publicly. For them, the privacy issues do not gain importance in sharing of most of their content.

As the management of digital content is rather new for people, the behavior tends to evolve and new forms of usage arise. Although studies on the related topics have been conducted, little propositions have been stated about how to support the found behavior patterns and user needs with new mobile services. Innovative tools for capturing or sharing various kind of content have emerged, see e.g. [7,18,19], but the rationale behind the new designs have not always been explicitly stated. Salovaara et al. [17] presented a few design implications, but more detailed guidelines are needed.

In this paper, we broaden the scope of the related work on content management services which has mostly focused on sharing photographs. Our focus is on studying users' needs related to sharing *life memories* in a broader sense, and how they could be created, used and shared with mobile devices. Based on the user studies, we form design guidelines for mobile life memory sharing services and present a prototype application which was designed according to the guidelines. The results of the evaluation of the prototype also indicate the applicability of the guidelines.

3. METHODOLOGY

The main goal of our study was to gain detailed understanding of the current and future needs, requirements and usage behavior related to sharing life memories with other people. Although the focus was on *sharing* the memories, we wanted to explore the various activities with memories, such as capturing, managing, browsing and searching, to understand their relation to the sharing related needs. A set of user-centered design and research methods were exploited: two rounds of interviews (thematic single and pair interviews, as well as focus groups), usage scenarios, contextual inquiries and prototype evaluation with user tests in lab. In total, 90 Finnish users with varying ages (from 18 to 80 years, mostly youngish, equally both sexes) and backgrounds participated in the study. Thus, potential users of the future services were highly involved throughout the UCD process.

3.1 User Needs Study

The goal of the user needs study was to tackle a wide set of questions regarding user needs, values, doubts and expectations related to sharing digital life memories. Special interest was set on sharing with mobile devices as we considered mobile devices to be the main platform in both capturing and sharing life memories in the future.

First, thematic interviews with single users, pairs of users and focus groups were conducted to elicit insightful data from various kinds of users. To cover an extensive set of users in various

phases of their lives, three types of users were interviewed: 1) *Young families with babies or young children*: two young families, not technically savvy, 2) *young people familiar with online communities*: one group with six users, all technically very apt, and 3) *people living away from their relatives*: three single interviews of people with varying technical skills.

These groups were chosen because of their presumed interest in sharing personal life events with their family and friends: young families about their baby, online community members discussing their common interests, and people living far away about their daily life to keep in touch with their relatives and closest friends.

The second interview round utilized textual scenarios as frame stories that were written based on the results of the first round. These scenarios were intended to provide broad and even provocative ideas for the focus group interviews. Eleven scenarios were composed – discussing various aspects of capturing, managing and sharing life memories: levels of sharing, real-time sharing, mobile automatic capturing, motivations, technologies, ethics, privacy issues, ways of sharing while mobile etc. To ensure the extent of results, focus group sessions were conducted with five groups: 1) *the parents*: four users, rather young, 2) *the elderly*: seven pensioners, 3) *the travelers*: five youngish users with varying technical skills, 4) *the enthusiasts* (car tuners): five middle-aged and youngish users and 5) *the athletes*: a close group with four middle-aged technically oriented users. Again, the purpose was to elicit thoughts from variety of people in various phases or situations of their life. We discussed 4-6 of the composed scenarios with each group in order to approach each scenario with several user groups.

These groups were chosen because of their potentially varying user motivations. The parents are highly motivated by sharing events concerning their children; the elderly have a wide range of memories to be shared and their perspective on time is long; motivation for sharing can easily be stimulated when traveling; enthusiasts have a strong need for sharing events connected directly to their hobby; the athletes were considered to have needs for saving and sharing special data (such as bio information).

3.2 Applied Contextual Design

After the initial user needs study, we used contextual inquiries (see [20]) to gain insight into the current usage behavior and sequences of two currently distinct memory capturing and sharing systems: camera phones and Flickr [3]. The specific focus was on revealing when, where, with whom, in what kind of situations and how users share memories, and discussing how these activities could be applied in the mobile domain. The Flickr users were investigated keeping in mind what features and activities currently performed in the PC domain could be carried out with mobile devices in the future. The main challenge in applying contextual design [20] was the fact that mobile life memory management and sharing contains tasks that are supported only in a very limited way in the current services. Thus, existing sub-tasks of mobile photography and PC based sharing of photos were taken as a basis for research. To avoid focusing only on photos and to complement the user needs study, the most relevant issues from the user needs study were interviewed in the end of the inquiries.

In the contextual inquiries, the target user group was youngish people who are interested in new technology and have experience on using services for sharing various kinds of digital content. In

total, ten contextual inquiries were carried out with both males and females, with ages varying from 25 to 35. The experience on photographing, using Flickr and using camera phones varied between various users.

After the inquiries, we continued the design according to Contextual Design method [20]. The interpreted data was classified on an affinity wall and consolidated sequence and interaction models were drawn. Also the notes from user needs study were integrated to the affinity diagram to ensure the cohesion between the two user study phases. Next, the resulted integrated affinity diagram, along with the consolidated models, was used to create design guidelines for mobile life memory sharing services. In total, 17 guidelines, of which six focused on sharing, were formed. The 11 guidelines not related to sharing are not presented in this paper because of their non-sharing focus (for instance capturing, organizing and editing). Furthermore, the six guidelines related to sharing were further elaborated into the four guidelines presented in this paper.

According to the guidelines, a mobile prototype was designed to be able to evaluate the usability of the design and the applicability of the guidelines. The Contextual Design method was used as a UCD method throughout the redesign and evaluation process. This included visioning a new way to work, designing UED models, and paper prototyping and evaluation in several iteration rounds. The same people who conducted the user needs research phase also designed the prototype of the service. The prototype and the guidelines related to sharing are both described in the Results section.

3.3 Prototype Evaluation

The evaluation of the created prototype was conducted in three rounds. The first two rounds of paper prototyping aimed at both ensuring the user acceptance of the general ideas behind the various features, and iterating the UI so that the next evaluation round could focus merely on the key service ideas – not the UI details. The first round was conducted with a low-fidelity paper prototype while in the second round the UI could be presented as mock-up screen images. The tests were conducted as single and pair tests with altogether 12 users (8 male and 4 female, 20-35 years old). To assure the cohesion of the entire study, the users in the evaluation rounds represented the same target user group as in the contextual inquiries. In the tests the users were given tasks to complete with a speak-aloud method. After the tests a more informal interview was conducted.

After two rounds of paper prototype testing, the final evaluation of the acceptability of the prototype as well as the tentative applicability of the guidelines could be conducted. The aim was to evaluate certain features and the main ideas of the prototype by pair tests and exploiting scenario working and role playing. Furthermore, with the help of test scenarios, further needs regarding sharing could be explored and the formed guidelines could be applied and further specified. The scenarios acted as frame stories when discussing the sharing of life memories and the developed prototype service as a conceptual tool for capturing and sharing. The users gave scores of certain parts of the design, and were also interviewed to elicit qualitative evaluation results. Altogether 12 users of the same target user group (7 male, 5 female) with ages 20-40 and varying technical skills participated this phase.

4. RESULTS OF THE USER NEEDS STUDY AND CONTEXTUAL INQUIRIES

This section describes the results from the user needs study (Section 4.1) completed with user needs related results and usage patterns from the contextual inquiries and final prototype evaluation round (Section 4.2). The results are focused on sharing, but also other phases of digital content management, such as creating, organizing and using, are discussed because of their implications to sharing needs and behavior. The results from the user needs study are presented on a device independent level because of the broad focus of user needs study, while the usage patterns focus more on the mobile usage.

4.1 User Needs and Motivations in Sharing Life Memories

Saving memories is a universal human phenomenon. People collect numerous immaterial and material things throughout their lives to remind themselves of the past. Some of these things are shared with others. Not all types of moments in life deserve to be saved or shared. This was apparent, for instance, from the fact that participants were very concerned that finally there would be too much material and much of that material would be useless. The most valued memories can be categorized into three classes:

- Happy moments (related to long term memory)
- Life history (long term memory)
- Details to aid taking care of the daily errands (short term memory)

Saving and sharing happy moments and life history data serves long term – even life span – memory. Currently these needs are served, for instance, by photo albums, diaries, collection of personal video recordings and archives or other tangible mementos. Saving detailed notes to aid in daily errands, on the other hand, serves more short time memory and corresponds to using calendar, note book or PDA. This can be an aid for example in remembering the schedule or one's health records.

4.1.1 Memories Are of Emotional Value

Users emphasized the emotional value of an event as a crucial element of memory. All events that have invoked feelings (positive or negative) are experienced worth remembering: birth of a child, graduation, a wedding or a funeral. These are the events people usually capture photos and videos of. When meeting with old friends, people like to flip through photo albums and discuss the occasions. The need to preserve reminders of the events which made one happy was a prevalent demand in all the participated user groups throughout the interviews. Of course some do not want to remember bad things in their life, but for many, even the negative memories were valued: it can be educative to see how one has developed from the past events and mistakes. Elderly people pointed out that the memories are not just your property, but they might belong also to other generations. Therefore it is necessary for the grandchildren and their children to see the past as “uncensored” as possible.

Interviewees stated that “true memories” can not be saved electronically, but with technology we can provide aid for remembering certain key elements of the event. Without these aids the memory may weaken, change its character or be forgotten. The

same goes for lack of recollecting: if we only have photos without the story told by the people who participated in the event, it is not a memory, but a plain historical document. Many of our interviewees preferred the face to face sharing of memories, perhaps due to the fact that it allows people to share emotions also on a non-verbal level. Users were very skeptical about the possibilities to save the emotional aspects of memories, even though video or audio recordings may be helpful. One interviewee explained that it is impossible to catch the feeling of a football game she had experienced in Milan, with a video or photos, since the experience included among other things standing in line, smells, physical contact in the audience, jumping and shouting.

Based on our results it is evident, however, that when the saved life event consists of multiform data it is more probable that it can later become a memory which the user values. Although a visual representation is highly valued, a good memento stimulates our auditory memory, reminds of the persons connected to the event, informs of the location and date of the event and so on.

Time perspective may radically change the way people perceive the emotional value of an event. For example, during one's own life scope the most mundane details can bring great joy when they are viewed from distance of 30 years: the apartment where we lived, the clothing we wore, and the environment in its original state. The evolution of the memory may be quite unforeseeable. When those moments were stored, it was not clear that it was these characteristics that would come so highly valued. This finding underlines the need to make possible the continuous saving of the events. If decision of the saving is left for the user only, too many events will be unsaved and forgotten for good.

4.1.2 Motivations for Sharing

Participants accepted the idea of online sharing of one's own memories in general. However, this does not mean that everybody wants to share everything with anybody. Instead, the interviewees want to have the control over granting rights to browse or edit their saved memories.

Table 1 shows an interpretation of the levels of sharing based on our interviews. Some users are eager to share all or at least lots of their saved material with everyone, while others prefer to keep the memories for personal use. A growing need for continuous broadcasting of one's life could be seen. A few users mentioned that they often have to share in a public forum to be able to share with the intended recipients. Even then, they considered the benefits from being able to share with these certain people greater than the drawbacks from sharing totally publicly.

The middle group in Table 1 (sharing with family, friends or involved) wants to choose carefully what they share with whom. Of course, not all friends are shared with every time. Sharing is performed with those who were involved or who could be interested. They stated that often the memories do not gain significance until they are shared. Generally speaking users are more interested in sharing happy moments, while negative memories are kept private. Also, users want to share the memories mainly with others who participated in the event; “outsiders” would not be interested in them. Moreover, they wished to see and hear also others' views from the same situation. From Table 1 we could also perceive the three-fold motivations for saving memories: personal growth and identity (no sharing at all), strengthening social ties (sharing with family and friends), and expressing/getting attention (sharing with anyone).

Table 1. The motivations behind the levels of sharing

	Privacy and trust	Motivations	Users' comments
No sharing at all "Private memories"	Memories are private in nature and others are probably not even interested in them. Sharing memory data might be harmful; people can not be trusted.	Memories are saved mainly for personal use. Saved items provide means to recollect, contemplate and develop myself. Personal growth and integrity are important.	"I enjoy recollecting precious, happy moments, but I can also relive through memory data boring, negative or even unpleasant moments of my everyday life."
Sharing only with family members, closest friends or people present in the event "Sharing strengthens relationships"	Memories are shared with trusted people. Other people might do you harm, if they had access to your memories. Not all can be trusted.	Sharing memories creates a feeling of community and belonging. Sharing strengthens relationships with others. Bonding over geographical distances is important.	"I like to make others happy by showing them funny and pleasant things." "I enjoy sharing positive memories and the developmental steps of children." "I like spending time and remembering past events with my loved ones."
Sharing with anyone "Creating new communities"	Everything can be shared freely.	Free sharing of all the saved events is a must in Internet age. It is a part of a new culture. Being presented in public is important.	"I like to get comments from other people – even strangers – about my saved memories and myself." "I have nothing to hide about my life." "Comments from others can be helpful."

Table 1 reveals that for the most part memories are not individual entities. They are created, defined, stored and remembered in a social context and all members bring some nuances into the memory. The memory is kind of a collage from all participants. It can be even argued that memory does not exist anywhere, but it is recreated every time, with minor changes to the story depending on who is recollecting it that specific time.

The contextual inquiries revealed that most recordings are created keeping in mind what others might want to see and hear from the capturing situation. Often, sharing was the motivation for capturing in the first place. As groups of close people, such as family or a group of friends, usually participate together in various events, recordings from different devices are then wished to be set accessible for the whole group and combined. Furthermore, if only a few group members participate in an event, the rest of the group wants to view the recordings afterwards, too. The studied small groups and pairs often regarded the shared

content as 'collective' – passing the boundaries of ownerships and rights of usage. This is due to the facts that 1) capturing the content is a *shared effort* 2) the *same group of people* appears in the content, and 3) the content is captured *for the whole group* – not just for oneself. Moreover, more sensitive and intimate content can be shared when knowing it will not cross the borders of that community. Hence, groups with close relationships share the need for creating collective archives (e.g. collective collages) to support the creation of group memories. This was further confirmed by the fact that most comments about the memory items are given by those people who were present – or should have been – at the capturing situation. Existing manners for sharing with each other by exchanging photos and other content afterwards were regarded both troublesome and insufficient for fruitful discussion and reminiscence to arise around them.

4.1.3 Trust and Ethics in Sharing of Memories

While being the subject of saved memories was in general viewed quite positively, the same view did not hold when the users were thought of as the object of saving (and sharing). The users expressed concern over being saved against their will or being unaware of the saving. They were mainly worried about being saved in an embarrassing occasion or in unfavorable mood; most often angry. Hence, new social codes are needed for saving public events. People need to know if their presence or behavior can be saved in a particular event, and they also wanted to have the right to deny from being saved or to be removed from the recording.

Participants were also troubled by questions dealing with trust issues. They want to keep their saved memory data in a safe place so that they can trust that the material does not get lost or destroyed. People also need to trust that the material does not end up in wrong hands, e.g. those who have shared memories will not forward them to unwanted persons. Finally users need to trust that they can easily access their material whenever and wherever they want. This need also includes the ability to remove one's memories from other persons' files.

Privacy issues, such as presented in [21], were only partially taken into account in the study. Inconvenient or humiliating content was not shared, but, for example, the identities of people in the photos or locations were shared rather readily. Nevertheless, the study pointed out that common ethics and rules related to sharing content often exist in small and close groups, such as a group of friends, a pair or relatives. It defines what kind of content can be shared: *how private* and *about what kind of objects*. The shared content was aimed merely at this particular group because it is not regarded interesting or useful for others.

4.2 Usage Patterns in Life Memory Management

In this section, we describe the usage patterns found from the contextual inquiries related to sharing. Initially, usage patterns were considered repetitive task or interaction sequences with the used or potential system.

4.2.1 Event-Based Activity as Common Behavior

The contextual inquiries pointed out that users most often capture photos and other content in bursts. The ordinary everyday life is rarely recorded but when the users are involved in something interesting, abundant recordings are taken in a short period of time. In addition, users often perform manual organizing to set the

content in order by time, event name or people. The organized entities are often shared as such, publicly or with selected people. Consequently, users often reminisce about their own or others' shared memories as entities by browsing the content in temporal order of the events. This was particularly emphasized in long-term memories. Because of the humans' episodic long-term memory system, this pattern is very natural. This was evident in browsing both digital content and concrete mementos. Similar results of event-based managing have been found out also in other studies, see e.g. [22,23].

Most users shared the need for sharing instantly. After something interesting had occurred, the experience had to be shared as soon as possible, almost news-like, before it would lose its topicality. This was emphasized in the mobile usage where the requirements for quality were not as high as in sharing in PC domain. Moreover, in common events the sharing often happened soon after the event to be able to annotate and discuss each one's digital memories. The motivation behind this is that users want to enjoy the content together – not separately or non-simultaneously. This finding creates requirements for new UI solutions to be designed for truly collective usage of digital life memories.

4.2.2 Significance of Face to Face Sharing

Users emphasized that it is essential to tell the story behind the memory item or reminisce about it together while of right after sharing. This was normally performed by face to face sharing. They said the mutual reminiscing about a common past event brings out the other's version of the memory and the facts are discussed and even argued about. If the receiver was not present at the capturing situation, the outsider's comments or wondering questions are momentous for the capturer by increasing the depth of the memory. This was emphasized especially in long-term memories, such as events from several years ago.

Personal annotations are usually created rapidly after the capturing to ensure that the memories would be as vivid as possible when viewed later on. The descriptive annotations often included descriptions of the current feelings, information about the atmosphere or other emotional elements that can not be automatically saved. For instance, "The scent of forest was very strong". The annotations are considered essential in order to others to get the most of the shared memories. Accordingly, this raises a challenge for life memory management service design on how to better simulate the natural face to face sharing.

Considering Chalfen's *Kodak Culture* [24] users, the mobile phone users in the contextual inquiries represented this user group well: sharing mostly face to face by telling related stories. In the contextual inquiries, the face to face sharing could be seen more as telling stories *about* photos, while public sharing, e.g. in Flickr, as telling stories *with* photos (cf. [24]).

5. DESIGN IMPLICATIONS

Based on the user study results presented above, we composed a set of guidelines for designing mobile services for sharing digital life memories. Analyzing the affinity diagram with walkthrough sessions brought out initially 17 main topics related to capturing, sharing and managing life memories. In the following we describe four main issues which were further specified in form of guidelines related to sharing. These guidelines evolved through the research and design process, especially during the final evaluation round of the prototype. After presenting the guidelines,

we briefly present the designed prototype service for sharing memories with mobile phones, and the user evaluation results of the prototype.

5.1 Design Guidelines

In the following we present our guidelines for designing mobile services for life memory sharing. Overall, many of these guidelines can also be used in design of other content management services (also on PC platform) and partially in design of other kind of mobile services.

1. Support sharing of memories in small groups and communities

Description: The service should support collective compilations, combining memories with other users and managing and viewing them together – especially within small and close groups and communities.

Examples: Most memories are suitable to be shared with at least the closest friends and/or family, and in mobile devices this sharing can usually be easily managed via the contact book or from the list of recipients from previously shared content. To support creation of common memories, 1) sharing quickly after capturing, 2) commenting and co-editing the memories, and 3) interaction and communication around them should be supported. The accessibility levels of various groups should be effectively manageable in order to check what usage rights people have and what not. As users might have several small recipient groups to share with, easily manageable grouping settings are required. For example, proximity information (e.g. identifying nearby mobile devices with Bluetooth) at the moment of capture could be used as a suggestion for a list of recipients.

Motivation: People want to share different types of memories with different people. The most memorable content is seldom shared publicly. Instead, the recipient groups are small and limited to those who were present at the capturing situation or who could be otherwise interested. People value the input and points of view from other users. Others' input can be comments and annotations on digital memories or on social interaction around the content when reminiscing about the common events. People enjoy sharing their memories with those interested or involved, and the possible attention from them. In other words, the traditional face to face sharing behavior within small groups of people should be supported. This means, for example, common verbal reminiscing about the memories and completing each other's stories. Thus, the memories often become collages of several users' memories. In addition, people want to preserve both the personal version of the memory and the collectively evolved version.

2. Let the user control the extent of the sharable memory

Description: Users must have the power to decide whether to share each content item or not. Also, the human filter for deciding about the extent of sharable memories is needed. With 'extent' we mean both the *depth* – the accuracy of the memory, e.g. amount of context related metadata or annotations to richen the memory – and *width* – the amount of content items that constitute a memory: from how long a time period, what kind of media formats.

Examples: A camera phone is not seen as a practical platform for manually selecting the extent of shared memory or editing the

sharable recordings. Thus, the advantage of quick sharing is impaired if laborious actions are required first. The realization of this guideline requires: 1) options to quickly select the to-be-shared content items and their metadata, as well as the recipients, almost automatically, 2) different privacy levels in capturing and sharing (what information is captured vs. what is shared), 3) perhaps features for automatic post processing before sharing and 4) semi-automatic settings to determine the extent of shared content and metadata (e.g. based on the presumed relevance and interestingness).

Motivation: People usually only want to share content that is relevant and interesting to others. Moreover, people want to control how good quality and what kind of content they share. On the other hand, some users emphasize the immediacy of sharing. The memory itself should include enough context data to tell the story and evoke users' own memories. However, users neither want to capture all metadata in all situations nor to share it with others. Users may not regard automatism credible enough to decide what metadata to share and what not. Yet, most of the various kinds of metadata types are seen as interesting and useful: location information, present people, user's bio information, textual descriptions, tags, communication history etc.

3. *Provide features for event-based sharing and management*

Description: The event-based behavior in creating, sharing, organizing and browsing the memories we found were so predominant that an event-based usage model should be utilized in new services for sharing life memories. The service should provide features for easy sharing of the recordings from the event with the people who might be interested.

Examples: The event-based usage model could be implemented by event-specific sharing settings and automatic tags, and utilizing calendar information in automatically interpreting the events. Furthermore, the service should provide ways to merge memories into yet larger entities, such as "the years in high school", "the top-5 concerts in my life", "my memories related to Ann". The service has to provide sophisticated tools for viewing both small details and large entities to support efficient and rich use of content – for the content to become a memory instead being merely a great heap of content. For this, flexible viewing levels for both content and metadata, and ways to select, annotate, enrich and tag various levels of entities are required. For example, providing links to related content outside the event (e.g. music or maps) or recordings of concrete mementos.

Motivation: People capture abundantly content in interesting or unique situations and real-life events (parties, happy periods of time, calamities, etc.) This applies also to organizing, editing and viewing the memories: people usually organize and view content by events and apply similar editing actions for all the content captured in an event. Hence, users should be able to manage content in meaningful entities. The event-based usage model does not restrict the ways to share both in real-time (instantly) with the co-located people and part of the recordings anytime later on.

4. *Provide features for going through the most recent events to support face to face sharing*

Description: The idea of being able to browse easily through the most recent memories came up with several users. Users want to

show the latest recordings to others face to face and discard part of them if necessary. The mobile UI features should provide efficient means for event browsing.

Examples: This guideline could be implemented, for example, by 1) providing browsing modes where also capturing is enabled, 2) support browsing of larger entities (life memories) at a time, 3) automatic and adaptive system for selecting the best shot before sharing, and 4) provide means for browsing the attached metadata visually. To be able to see other users' related recordings requires information given to the user when shared memories are available.

Motivation: Often, several takes are captured from the same object or situation. Consequently, choosing the best one(s) right after capturing is required. Users stated that the current tools for this are inadequate – either too slow or focusing only on the most recent single recording. This is emphasized when there is little storage space or a poor quality capturing device. Being able to quickly browse the most recent recordings also makes it easier to comment them and add metadata, meaningful relations and descriptions. Moreover, this supports the face to face sharing of memories quickly after creation, and thus the evolving and augmenting of the memories through telling stories and discussing the event. In addition to self-captured recent memories, users also wish to see others' related and recent recordings.

5.2 **Concept Prototype of a Mobile Service for Sharing Life Memories**

To evaluate the usefulness and feasibility of the design guidelines, we used them to design a concept prototype of a service for sharing memories with mobile phones. We used the results of the users needs study and the following Contextual Design process to design the prototype. The designed prototype focuses on photo and video media types of life memories but the interaction concepts are extensible also to the recording and utilizing of rich context related data. The prototype is briefly introduced below, including the features which were designed by the presented guidelines. The prototype is described in [25] in more detail.

5.2.1 *Introduction to the concept prototype*

The prototype application was designed for capturing memories, sharing them and automatically organizing them while mobile. The memories can be any content put in the service, such as photos, videos, audio, communication logs, blogs or other writings. The memories can be enriched with various context data from surrounding capturing context, such as location and bio-information, and user-input tags and annotations. The designed prototype could be thought as a significant enhancement on current mobile phones' camera and gallery applications. As the content would be stored in a remote server, the service can be used with various kinds of mobile terminals and equipments. To provide even more efficient tools in managing the memories, the service could be complemented with a PC UI for browsing, organizing and editing the memories.

Figure 1 briefly illustrates various parts of the mobile UI. Due to the guidelines, the collective use of the media content is emphasized in the prototype. User can easily share content by forming events of the media items and sharing the event to a certain user or groups of users. Event creation and its effects on other functionalities of the prototype is described in more detail in Section 5.2.2.

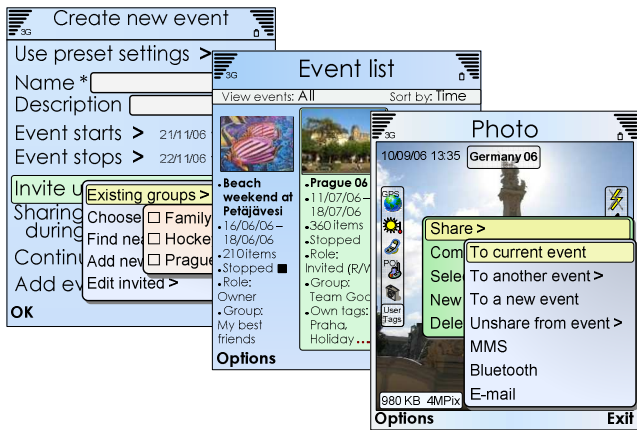


Figure 1. A set of mock-up screens of the designed prototype service: Settings in creating a new event (left); list of events the user belongs to (middle); and manual sharing of an event after capturing (right).

5.2.2 Event-Based Approach

The initial fundamental implication of the guidelines was the design of an event-based usage model. Naturally, this event-based usage model would affect all main parts of the functionality of the application: capturing, organizing, sharing and browsing. One burst of recordings can be regarded as one event, and it is natural to organize, manage and browse the recordings in entities according to real life events. The main design implication was that the users can create virtual events with their devices to store all the captured memories from the real-life event in one place, for example a server in Internet.

An event can be regarded as a defined period of time that has certain common characteristics, for example a sporting event, rock concert or a night with friends. Users' activity, needs for capturing content and interaction with it remain at least partly constant during the real-life event. Furthermore, the people related to the event and interacting with the user may remain mostly same. Hence, the primary idea with event-based usage model is that the memories thus often become *collective*.

5.2.3 The Collective Aspect in Events

A single user sets up the event and invites other users to the event to share their captured content with the group. Thus, users can easily share recorded memories by sharing the event with a certain user or a group of users. To help collecting all relevant event content into one collective memory, different users' memories from the same real-life event can also be merged. By being collective the event contains all the content relevant to the group memory of the real-life event. Yet, the recordings of various group members from the same event might differ from each other. Hence, the collective memory can be seen as a dynamic collage of personal memories as all group members have a slightly different personal version of the memory. Moreover, users may decide which recordings are shared with the event members, and which are kept private. Every recording or other content objects can be shared either manually or automatically. Furthermore, the various context data types can be set public or private. The amount of manual selections due to selecting sharable information is reduced by the event-based settings. Regardless, these have an implication that each user also might have a slightly different collection of recordings from the event – the collective and her own.

5.2.4 User Roles in the Prototype

Although a single user sets up the event and invites other users to the event, all the content shared within the event is collective: every invited user has the same rights for viewing and annotating the content. However, modifying and deleting are limited to the user who shared the content in the collective event. This open approach was designed especially for the needs of close groups with mutual trust, such as groups of friends and families. Thus, only two different access right levels are needed in the mobile UI: the event's creator and the invited users. In addition to using previously used user groups, new groups can also be created by selecting users from the phone book or finding near-by Bluetooth devices to form the group of invitees. Such instant and collective way of sharing helps interact with both the co-located and remote users and use the truly collective memories anytime, anywhere.

To go through the recent events, the prototype contains a feature which quickly shows the events' most recent shared content. With annotation and tagging tools, the memory could thus be quickly completed with descriptive metadata. To be exact, these include both the users' own and others' shared most recent memory content.

5.3 Results of the Evaluation of the Concept and Guidelines

The results of the final user tests with altogether 12 test users gave us insights of the usability and acceptability of the prototype. As the prototype was designed with the help of the guidelines, also the usefulness of the guidelines could be evaluated on a general level. In the following, the curly brackets indicate which guideline {1-4} the user feedback relates to. Of course, the amount of users agreeing on each issue is not reliable as a quantitative indicator of general user acceptance. Yet, it provides preliminary information about the usefulness and applicability of the guideline.

5.3.1 Event-Based Usage Model

The prototype received generally good acceptance feedback from all 12 test users. Users appreciated the idea of creating the event and quickly discovered the benefits of using it {3}. 10/12 users regarded event-based functionality significantly better than their current mobile phone gallery and recording software. They regarded event-based usage model useful especially in real-time sharing and organizing a collective memory {1, 4}. Most users required the event settings to be changeable anytime because the length and even the invited group might change, even during the event. Furthermore, creating the events afterwards has to be supported in order to be able to organize content in events also in case the event was forgotten to create. Preset settings in event creation and group invitation features were seen as useful in creating an event in hasty situations. Many users stated that many awkward phases, such as manual sharing, adding tags and organizing the recordings, are improved in this prototype compared to their current mobile services in use {2}. Even with the prototype's unpolished UI, 11/12 users regarded creating the event useful enough to bother doing it.

As the users did not consider usage of mobile phone as main thing in real-life events, the use of the mobile UI was seen to be limited mostly to capturing and instant sharing. Most annotating, tagging and editing tasks would certainly be performed afterwards. However, even these 'incomplete' memories would be shared in

most cases almost instantly. Further work with the memories would be done afterwards and the memory would thus naturally evolve {2, 4}.

5.3.2 Collective Events

The collectivity was the most appreciated aspect in the event-based usage model. All test users were interested in the idea of several users being able to save their recordings in one event accessible by others – still without losing the power to determine the recipients {1, 2, 3}. They also stated that it would be interesting to save both the private and the collective version of the shared event. Thus, it would be possible to reminisce about the event from different points of view – personal or collective {2}. The manual selection of how extensively the memory would be shared divided opinions: 5/12 users wanted to manually select the attached metadata even in real-time sharing situations, while 7/12 users would have trusted the automation or event-based preset settings in sharing metadata. Thus, the event-based settings for capturing and sharing related metadata require more versatile options {2, 3}. Obviously, the dilemma is how much more effort is the user willing to do to be able to maintain the power to choose what details to share.

Users could also propose ways of using event-based usage model extended from the original idea of short events: an event with your spouse lasting continuously; sub-events to indicate, for example, a small trip during one's holiday event; ad hoc group creation in public events; a repetitive event where, for example yearly or weekly, memories could be stored at certain time intervals (e.g. capturing a photo of oneself every day during one year or a school photo of every year). For such usage the event should be able to put on pause and retrieved later on, or some other notation (e.g. tags) could be used to mark these kinds of event entities {3}. All the 12 users stated that the possibility to quickly view the most recent memories was attractive and something that should be focused on in future services. Thus, one could instantly view the recent happenings and maybe mark which ones to view later on more carefully. It also provided a way to see how the memory develops by annotations and context data be added gradually {2, 4}.

5.3.3 Real Time Commenting Aspects in Sharing

The event-based usage model supports reciprocal commenting and collective reminiscing both simultaneously and non-simultaneously, and 11/12 users regarded the prototype to support well the natural way of face to face sharing {1, 4}. Users stated that the received material should be somehow prioritized: often, users prefer only little material to be received real-time (e.g. communication, personal messages, newsworthy moments, most humorous recordings). Most material is desired afterwards: non-urgent material, such as sceneries, documentary videos, collages of the best recordings, semantic metadata and textual descriptions {4}. This depends on whether the event members are in same or different places and the nature of event. For example, in sports events it was appreciated to receive others' points of views in real-time.

6. CONCLUSIONS AND FUTURE WORK

The main contributions of this study are the increased knowledge of users' needs regarding sharing of digital life memories, and the design guidelines which were formed based on the user study. *Life memory management* can be regarded as an extension of

'traditional' content management, which has recently been studied in related work. Nevertheless, this research has revealed novel issues that need to be emphasized in the design of services for life memory management: the significance of meaningful event-based entities; management of rich and semantic metadata; and the high emotional importance of the digital memories which determines how much of the memory can be shared with various other parties. The presented guidelines help application designers and HCI specialists take into account the novel elements of management of life memories via mobile services.

The need for sharing different kinds of memories is a fundamental human need. However, the extent of sharing – what data, with whom, and when – varies between users and contexts. The most dominant precondition of sharing a memory is its interest for the intended recipients. Hence, the user should be able to create settings for various accessibility levels.

One of our major findings was that capturing, sharing and viewing memories are performed usually in bursts – based on real-life events. The events are usually experienced with a selected group of close people. Thus, it is most natural to share the memories of the event as an entity with the related group. This often leads to reciprocal activity of sharing each others' memories and commenting them. Regardless of the existing, inherent needs for sharing life memories, it is a very sensitive and developing area of user activity on digital platforms. The traditional behavior, such as face to face sharing, still thrives and most users' are not used to the abundant sharing of their digital memories. We see that the event-based sharing and managing behavior and the emphasis on sharing memories within small communities' serve as promising concepts in designing future services for life memory management.

The design guidelines were composed considering both the general usefulness and the specific design challenges of our concept service for mobile life memory sharing. Thus the extent and general suitability between guidelines varied. For example, the *community based sharing (1)* and *event-based management (3)* guidelines could be used also in designing other than life memory related services. As we designed only one prototype service, not all guidelines could be evaluated with similar precision. The *event based sharing* was in specific focus while the guideline *going through the most recent events (4)* could not be assessed as explicitly. Hence, the guidelines could only be validated tentatively and the evaluation results with 12 test users can not serve as quantitative indicator of the usefulness of the guidelines. Our guidelines partly confirmed the design implications presented by Salovaara et al. on related issues of collective content management [17] – especially the “*Creating a 'common' space*” and “*Enabling the emergence of collective objects*”. Conclusions related to our guidelines *the extent of the sharable memory (2)*, *event-based management (3)* and *going through the most recent events (4)* have not been presented in related work.

Although the results and guidelines can be applied also to other than mobile services, we believe mobile devices to be the main platform used for creating, managing and sharing life memories in the future. Mobile devices are becoming versatile enough for capturing rich memories with context-related semantic metadata and sharing them with others both remotely and face to face. Via

usable mobile services, users will be able to share, enrich and enjoy the memories “anytime, anywhere”.

Further research is needed to generalize the applicability of the design guidelines. The generally good acceptability of the designed prototype partly certifies that the prototype matches the sample users’ needs, but the guidelines can not be completely validated by that. The guidelines require further evaluation by both designing further services utilizing them and supplemental research results on sharing various kinds of life memories. To study the acceptability of life memory sharing services, a functional prototype should be implemented and a long-term field study to investigate the usage should be conducted.

Related to the found emphasis on collective usage of memories, we have recently been studying the concept of *collective memories* with a field study on four user communities (see [26]). The study provides knowledge on usage patterns and life cycles of various types of content shared within close communities. Also, we are studying further what context and metadata digital memories should include and what users regard acceptable and useful to be shared. The collective aspects of memories require further prototype implementations and their user evaluations. Also, it is important to investigate how collective, event-based memories illustrated in the prototype presented in this article will be used in real usage contexts, over a long period of time.

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