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Practices Surrounding Event Photos

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Abstract. Sharing photos through mobile devices has a great potential for creating shared experiences of social events between co-located as well as remote participants. In order to design novel event sharing tools, we need to develop in-depth understanding of current practices surrounding these so called 'event photos'- photos about and taken during different social events such as weddings picnics, and music concert visits among others. We studied people's practices related to event photos through in-depth interviews, guided home visits and naturalistic observations. Our results show four major themes describing practices surrounding event photos: 1) representing events, 2) significant moments, 3) situated activities through photos, and 4) collectivism and roles of participants.

Keywords: Photo-sharing, HCI, Design, Ethnography

1 Introduction

In the last decade, the notion of domestic photography has emerged to describe a set of photographic activities, including capturing, recording, and sharing, of ordinary people creating and utilizing images for non-professional purposes [23]. To Slater [24], it is a constructed act, where a specific area is located on the camera viewfinder and people give a particular pose to the camera. After the capture, photos are (collaboratively) selected, uninteresting photos are kept aside, and a selection of photos are shared, archived or even framed in people's homes. Photos created in such a way help people construct a positive image, individual or family identity and support their emotional, sentimental and nostalgic needs [23].

Sharing events through photos has become a genre within domestic photography. With the advent of smartphones and related portable mobile technologies, it has become easier to share photos and other relevant media such as music, videos and texts while on the move. Mobile phone based event sharing applications such as Vivogig, Google+ Events, Color and Facebook Events are a few examples of existing tools. In the HCI community, a number of studies have contributed to the genre of event sharing. For example, Jacucci et al. [14] studied how participants using multimedia-

capable mobile phones collaboratively shared their experiences at a large-scale car racing event. Brown and Chalmers [5] studied practices and behaviors of tourists, in order to provide design implications for novel event sharing tools (related to visits and travels). George Square [6], MySplitTime [12], Automics [11], and Columbus [22] are a few examples of tools that support event sharing experiences via photos.

In this paper we focus on 'event photos', as an integral part of domestic photography. We define events as any spontaneous or planned activities that have some level of social meaningfulness, for example, weddings, birthday parties, vacation trips or picnics, amongst others. Photos taken during such events or about such events are termed as event photos. The context and social meaningfulness are central to event photos. We use the notion of 'events' as a lens to understand people's practices surrounding domestic photography and inform the design of novel technologies that can support event sharing. As such, we are not interested in differentiating event photos from non-event photos.

To understand the importance of event photos and how they are dealt with, we carried out a field study. We applied three different methods in our study: in-depth interviews with 17 participants, guided home visits to 9 families, and naturalistic observations at 4 event locations. In this paper, we will provide a detailed analysis of our study and describe our results in four themes describing practices surrounding event photos: 1) representing events, 2) significant moments, 3) situated activities through photos, and 4) collectivism and roles of participants. Using results of our study, we also provide implications for designing novel event sharing tools.

1.1 Motivation: Why Event Photos?

As we started our research on event sharing via mobile devices and relevant technological explorations, we realized that there was a lack of literature on how photos were taken during events and what features of such events were captured more than others. There was certainly enough material on photo archiving, sharing and curating and also on sharing via mobile devices (see [23] for an up-to-date review). However, to what extent this literature could inform the design of innovative event sharing tools for mobile devices was not clear to us. For example, what are the motivations for taking photos when people go to events – both public and private? What strategies do people use when capturing event photos? How are event photos shared, and what are the motivations for sharing such event photos? Similarly, how significant are these event photos in people's everyday lives and how are they curated and archived for long term use?

One might argue that the majority of photos that people capture and share may already have relevance to some kind of events. Hence, what value may such an explicit focus on event photos bring to the HCI community? We believe that there are several reasons why event photos need an explicit focus:

Different events have varying social order and social dynamics. Some of these orders and dynamics are formal (e.g. wedding) and others are casual and ad-hoc (friends meeting at a pub or a picnic place). These events affect the nature of photos and the role of a photographer and people who are taking part in the event. For exam-

ple, one might be less motivated to bring a large-sized DSLR camera to a pub gathering of friends. One might just walk-in without any extra effort knowing that a camera phone would be sufficient for such an event. This not only shows the significance of the event but also people's attitude and expectations from such events.

Events also have their moments of significance that can be worth capturing and without which the event may lose its integrity or value. For example, candle blowing at a young child's birthday party is an important moment that should be captured. Similarly, at a wedding, the exchange of rings or the first dance could be seen as significant moments. Depending on different cultures, these significant moments may change but the tendency to capture such moments is pervasive.

While taking photos at an event, one is both experiencing and capturing a moment at the same time. Elements of "lived" experiences may not be easily conveyed when these photos are shared via email after the event is finished. The situatedness of events shape the way photos are captured, shared and interacted with. Similarly, captured photos may also affect people's activities and behavior. Recent smartphones do allow sharing of photos immediately after they are captured via, for example, social networking services (SNS). But is that sufficient for sharing an event? Also the photos that are captured during an event can be seen as collective contents [20]. There might be some interesting privacy issues that need to be explored.

We believe that there are many such issues that can be answered by a better understanding of event photos. A field study in this area can allow us to assess current practices and methods people apply in capturing, sharing and using event photos for a longer-term.

2 Related Work

2.1 Photos in Homes

Chalfen's [7] work pointed out that the primary value of domestic photography is related to memory, identity and communication. He coined the term Kodak Culture, referring to the traditional family practice of sharing printed photos or video footage of friends and family in a collocated environment. The HCI community has since seen a rich body of work in this domain, focusing on organizing, sharing and displaying photos in homes. Using observations and interviews, Kirk et al. [16] developed the notion of photowork that describes different sets of activities that users perform on their digital photos after the capture but prior to sharing. Photowork highlights the efforts and complexity of practices such as reviewing, downloading, organizing, editing, sorting and filing. Focusing on the sharing aspects, Frohlich et al. [13] developed requirements for photoware – an application that supports storage, sending and sharing of digital photos. Crabtree at al. [9] studied conversation patterns around collocated photo sharing with a goal to support distributed collaboration. Recently, some ethnographic studies have also looked at how families curate and display photos around their homes. A set of studies from Microsoft Research [10, 25, 26] has illus-

trated how different physical setups (e.g. walls, mantelpiece and shelves) in the homes are utilized by family members to display important photos and how such displays are tightly interwoven into the very notion of family and home. Drawing from four different studies, Van House [27] showed different ways people share photos in their home, using prints, photo albums, slideshows, via laptop screen and so on. In her later work [28], she describes personal photography as overlapping technologies of memory, relationships, self-representation, and self-expression. A journal special issue on 'collocated social practices surrounding photos' [17] elicited three broad themes: reflection and remembrance; performativity and expression; and connection and communication.

2.2 Photos in the Online World

Echoing the storytelling aspect of photos in the offline world, Balabanovic et al. [3] explored two categories of methods people used in telling stories from digital photos: photo-driven and story-driven. Using semi-structured interviews, Miller and Edwards [19] studied digital photo sharing practices of 10 participants on Flickr. They explored two categories of users: people who were still following the Kodak Culture and 'Snaprs'. Snaprs are the ones who shared their photos even outside of their social network with fewer concerns for privacy. Their immediate focus was on taking photos then sharing them to relevant people. Ahern et al. [1] identified four factors that could affect people's privacy while sharing digital photos: security, identity, social disclosure, convenience. Bentley et al. [4] compared personally captured photos to commercially purchased music and found several similarities. From this comparative study, they found out that 1) users search with fuzzy concepts and settle for an "okay" option, and 2) users change their mind during the search process and end up with something completely different.

2.3 Photos in Mobile Devices

One of the earliest studies on photo sharing through mobile devices was published by Mäkelä et al. [18]. These researchers identified that people shifted from telling stories about the pictures, to telling stories with the pictures. Kindelberg et al.'s [15] study of camera phone users led to taxonomy of six affective and functional reasons for image capture on a camera phone: individual personal reflection, individual personal task, social mutual experience, social absent friend or family, social mutual task, and social remote task. Ames et al. [2] have provided detailed requirements for mobile photoware. Olsson et al. [21] studied users' needs for sharing the digital representations of their life memories. They identified three main motivations: personal growth and identity (no sharing), strengthening social ties (sharing with family and friends) and expressing/getting attention (sharing with anyone). In a field study, Jacucci et al. [14] explore how people actively construct experiences using mobile devices capable of sharing multimedia content. In particular, the authors suggest that continuity, reflexivity with regard to the self and the group, maintaining and re-creating group identity, protagonism and active spectatorship were important social aspects of the experience.

Another such event sharing study that comes close to our own research interests was done by Esbjörnsson et al. [12]. From an ethnographic study at car racing venues in the UK and Sweden, the authors describe of three interesting findings that can be useful for supporting event sharing at car racing venues: viewing paradox of spectating, active spectating and role of sociability. Brown and Chalmers [5] also use the notion of events, where they study behavior and practices of tourists in order to derive implications for tourism related tools. Automics [11] is a mobile application that allows users to collaboratively generate photo collages using photos from different sources in a theme park setting. Columbus [22] provides a location-centric event sharing experience, in which, by walking around different locations users can unlock photos that are digitally associated to different locations. Adding voice and location modality to photos, the George Square [6] system allows users to access historical data from previous visits to be able to collaboratively explore physical places.

3 Field Study

We used three methods to study event photos: 1) in-depth interviews, 2) guided home visits, and 3) naturalistic observations during real events. For the in-depth interviews, we created an online survey to collect information about our potential participants' interests and experience in photography, their current practices and their availability. Our survey was completed by 40 participants out of whom 17 were invited for in-depth interview sessions. We selected these participants based on their diversity of experiences and photo taking practices. Details of our participants are in table 1a. In the follow-up interviews, figure 1 (left), participants were asked to bring at least 10 photos from three of their recent social events. During the interview, we first asked questions about their capturing, sharing and archiving practices related to photos. In the second part, we asked our participants to describe the three events, using photos that they had brought. Some example questions are provided in the following:

- What tools have you used for capturing, storing and sharing these images?
- What was your aim and motivation behind taking this picture?
- What does this picture signify in your life?
- Were these pictures ever discussed with others? How?

Fig. 1. A participant describing her event photos in the interview session (left) and a family showing their photo albums in the home visits (right).

- How do you classify these photos?
- Do you use any of these pictures as memento? Why?

With the permission of our participants we audio recorded these interviews and used their photos for our analysis. These participants were given a gift at the end of the interview session as a token of appreciation.

Table 1. Details of our participants in interview (a) and home visit sessions (b). § We had involved all five participants in this session including the grandparents of the family (#4) who were staying with them at the time of our visit.

In-depth Interviews

#	Gender/Age
1	Male/34
2	Male/30
3	Female/30
4	Female/24
5	Female/26
6	Female/32
7	Female/44
8	Male/48
9	Male/30
10	Male/44
11	Male/27
12	Female/34
13	Female/31
14	Male/28
15	Male/21
16	Female/47
17	Male/40

(a)

Guided Home Visits

#	No. of Members
1	5: 1 – Father; 1 – Mother; 3 – Daughters
2	3: 1 – Father; 1 – Mother; 1 – Daughter
3	4: 1 – Father; 1 – Mother; 2 – Daughters
4	5[§]: 1 – Father; 1 – Mother; 1 – Daughter; 2 – Grand parents
5	3: 1 – Father; 1 – Mother; 1 – Son
6	2: 1 – Mother; 1 – Daughter
7	4: 1 – Father; 1 – Mother; 1 – Daughter; 1 – Son
8	4: 1 – Father; 1 – Mother; 1 – Daughter; 1 – Son
9	2: 1 – Husband; 1 – Wife

(b)

In the guided home visits, we recruited 9 families, from the Helsinki region of Finland, using a similar kind of survey as we used for our interview sessions. The overall process of these home visits was very similar to our interview sessions. But here we also wanted to explore their curation and display of printed photos. We also used a similar approach in discussing the event photos – describe 3 events using at least 10 photos. In some cases, families used their computers to describe these events and in others they used their physical albums and other printed photos. Figure 1 (right) shows a family describing an event using their physical albums. The details of our

home visit participants are provided in table 1. The complete home visit was audio recorded and a large number of photos were captured depicting interesting photo archiving and displaying practices. These families were also given a gift at the end of the interview session as a token of appreciation.

Thirdly, naturalistic observations in real events were carried out in a very informal way. We visited 4 places (a zoo, an amusement park, a cultural event and a public park) to observe how families and groups of friends take pictures. At times, we approached some of the visitors who were taking pictures and asked them about their motivations behind taking such pictures and how they would share them with others. We took notes whenever it was necessary. Although these observations were very informal and ad-hoc, our intention here was to gain naturalistic insights into events.

At the end of our field study, we had collected a large amount of field data in the form of notes, photos and audio recordings. In addition, we also used event photos that were discussed by our participants at the time of the interview and home visits. We did a qualitative data analysis and used affinity wall exercise to explore patterns and after discussing with other members of our team, we developed our results.

4 Findings

In the following, we provide findings from our field study focusing on four major themes that came out strongly in our analysis of the collected data. These themes are representing events through photos, capturing significant moments during events, situated activities through photos and collective effort and roles of people.

4.1 Representing Events

Based on our interview and home visit data, we found that representing and documenting actual events in the form of photos was one of the most visible practices. Participants attempted to represent relevant activities that happened during events through a set of photos. We noted that formal events such as weddings, baptizing of a child, and wedding anniversaries were always well documented via photos. The main reason for documenting such events was that these events signify a great value in their lives and they could go back to these event photos as important memories of celebrations and achievements.

From the field study, we found that our participants used some interesting strategies while they captured photos during events. One of the most basic strategies was to capture the relevant persons (either in group or individually) who were part of a social event. In particular, capturing 'group photo' was a widely used strategy to represent who were present at a given event. Figure 2a shows an example of this strategy, where an interview participant (#2) who attended his brother's wedding, took a photo of the two main families for remembering the event. In contrast to the above example, an interview participant (#1) who went on a picnic trip with his friends from a Facebook based social club commented: *"I have been to many trips with friends whom I meet only casually. I would always suggest taking a group photo on the first day or at*

the time when people meet for the first time. You never know, on the last day things may have gone awkward and you may never get a group photo." The above two examples show how group photos serve different purposes for formal and informal events.

(a) (b)

Fig. 2. (a) A group photo, capturing important people at a wedding and (b) Photo of an old church for documenting a trip.

Capturing photos of different activities during events was also a strategy used by our participants to represent their experiences in events. During formal events, such as weddings, the intention would be to capture the sequence of all important activities. On the other hand, lesser significant events such as going on a vacation trip, visiting an amusement park or going to a concert were documented with less focused intentions. For example, figure 2b shows a photo from a participant from our home visit (#1) who attempted to document a broken church that his family saw during their trip to Russia. Even though the photo did not have any strong significance to the trip, the participant took this photo mainly for documentation purpose.

The nature of events also played an important role in our participants' motivations for taking photos. In some cases, participants who had plans to visit a new place (during vacation or work related visits) took their DSLR cameras with the expectation that they might see something interesting in a new place. On the other hand, participants' attitudes differed when they visited known places. Here is a comment by one of our participants (#9) from the interview sessions; *"I wouldn't bother to bring a camera with me if I am going to visit my friends in Turku* (~165 km from Helsinki). *Because I know that place very well and I know that nothing interesting would happen when I am there."*

Another interesting photo capturing strategy was to take photos depicting a starting point and an end point – hence enabling storytelling (Van House, 2009). During the field study, all the participants started describing their events from a photo that was taken at the beginning of an event and finished their conversation at a photo that described the end of their event. In the interview, we often heard our participants saying *"this is how we started the trip"* and similarly, *"this was the last day of our vacation"*, for example. This finding shows that all events carried a story and a narrative that was always conveyed through their photos. This practice was observed in almost all participants and it was a useful way of not only documenting but also remembering an event.

4.2 Significant Moments

The second theme that came out strongly in our study was how participants attempted to make sure that the significant moments and aspects of events are always captured. Moments such as blowing candle on a birthday cake, first dance at a wedding or giving toast at an anniversary party are obviously important and can be termed as central to defining such events. Similarly, during non-formal events such as vacation trip or any other type of outing, there are moments that define or characterize the whole trip. In this section, we will describe our participants' motivations and practices related to such important moments in events.

Participants captured photos of novel, rare and significant aspects of events to shape their experiences related to events. As we mentioned earlier, some events (e.g. a wedding) have a defined social order and there are observable moments of significance such as exchanging rings or a wedding speech. These significant moments were very carefully captured. Figure 3a shows an example of a significant moment at a 50th wedding anniversary celebration of our participant's (#11) parents, where he took a photo of his elder brother giving a gift and making a toast to their parents.

(a) (b)

Fig. 3. Examples of significant (a) and iconic (b) moments during different events.

Figure 3b shows an example where our interview participant (#2) had gone on a trip to Africa with his friends. At the end of the trip (which was described as very "hectic" and "difficult", in his words) all the three friends had lost a considerable amount of weight and were very relieved to go home. Figure 3b shows an iconic photo of the three friends traveling in a boat to catch a flight back to the US. Our participant gave the following comments on the photo: *"this was an iconic moment of our trip. It summarizes our whole trip. It shows how tired we were and how much weight we had lost in that short trip… I took this photo when my friends were resting. And they were quite surprised when I sent them this image after reaching the US."*

The significance of events and people in them make a photo important enough for sharing and archiving for a long term use. Figure 4a is a postcard created by our interview participant (#12). The original photo was taken during a holiday visit with three of her friends, who got together after a long time. After the holiday, a postcard from this photo was created and was sent to the other two friends to cherish memories of that event. The participant commented: *"this photo represented a nice holiday with my best friends, so I thought a post card would make it even more memorable."* From

the home visits, we found that photos related to children were frequently displayed on living room walls, fridges, mantels and desks. Most of the families (#1 to #8) who had children kept one or more photo albums for collecting childhood memories for their children and for record keeping purposes. Figure 4b shows a page in a photo album, which shows a set of photos from a baptism ceremony of a child belonging to the family (#7). During our home visit session, the mother of this family indicated that she has made detailed annotations about this event on the album itself. She stated that, *"Without annotations things can be forgotten."*

(a) (b)

Fig. 4. A postcard created from an event photo (a), and Photo album depicting a baptism ceremony (b).

4.3 Situated Activities and Photos

We observed that certain activities and interactions during events led to capturing and sharing of photos and the other way around. The effect of this theme was observed during events as well as after events. In this section, we will provide examples from our participants who supported interaction through photos and vice versa.

In the following we provide a short account from a family who participated in our home visits (#1). The family organized a trip to Russia with other close relatives to see their ancestral birthplace. Our participant gave the following account about this event: *"My father is 80 and is not well at the moment. He asked me and my brother to go to his birthplace which used to be a part of Finland before the war with Russia, but now is in Russia. He couldn't visit that place after the Soviet Union came. My father gave us some old photos of that place and told us to go to his village and get photos of its current look. We were accompanied by our uncle who knew a bit about this place. When we arrived at the place, we did some sightseeing around the village, saw the building where he lived, went to a church nearby that was completely deprived and some of the places that my father often referred to. We could almost compare the photos he gave us with the current state of the location. We also saw our family names written in that church. While we were walking around the place, our uncle used these old photos almost like a map and guided us through different locations in the village. By comparing the old photos to the current situation he also told us lots of stories about the place: what they did when they were kids and what their*

life was at that time. My brother and his kids also took a lot of pictures around the area." The example shows how photos from the past aided and guided the family to look around the place and imagine how the life was fifteen years ago. Importantly, as mentioned by the participant, these photos served as a "map" and itinerary of different locations that the family might visit. This example show how old photos supported tourist activities and how the parts of the trip were guided by these photos.

There were also examples where photos captured during an event led to interaction within groups. In the interview session a participant (#17) gave an account of his family trip to Lake Garda in Italy. The family had decided to go to two different places during a day, where the father would accompany their son and the mother would accompany two daughters. The following interview excerpt shows how using MMS the groups shared their photos, which led to photo based interaction. *"Since we had a lot of ground to cover and had just one more day remaining in our trip, we thought to go to different places around Lake Garda. After a few hours I got an image from my wife where one of my daughters is shown with a teddy bear. She then immediately called me and told me that Mia – our daughter has won a teddy bear in a shooting game at a local gathering. When I showed it to my son he also urged me to go to a similar place. Unfortunately, at our location there wasn't anything like that. So, I brought an ice-cream for him and sent his photo with the ice-cream to my wife's phone. This way of conversation happened a couple of times."* This excerpt shows how the situatedness of photos allowed the two groups to communicate and communicate fun at each other.

Central to this theme is the phenomenon of how "lived" experiences are shaped through photos. The example of the family trip to Russia shows how old photos given by the ailing father served as a tool not only to navigate through the village but also worked as an experiential artefact [29] which allowed the family to experience the trip from the perspective of their father. The example where a family splits into two groups highlights how lived experiences are shared by sharing photos via mobile phones.

4.4 Roles & Collectivism

One of the interesting aspects that came out from our field study was the roles different people played within the context of domestic photography. Sometimes the role of a photographer was explicitly assigned and sometimes it was assumed. For example, a wife who participated in our home visits (#9), mentioned that once she was asked to be a maid-of-honor at her close friend's wedding, which implicitly included the duty of taking photos during her friend's bachelorette party. In another case, an interview participant (#3) was asked to take photos at a social event where she was also part of the organizing committee. In different cases, tech savvy members of families were simply assumed to take care of photo capturing during events.

Collectivism was another aspect that came out very strongly in our work. In several examples, we observed that photo capturing was divided between different people in the event. In the example where a family went to Russia to visit their ancestral place, several family members including children had cameras with them. The participant that we interviewed mentioned, *"At this moment, I am collecting photos and stories*

related to them, from all the family members and planning to make a photo-book out of this trip. If we go back to the same place again in ten years, we won't have anybody telling stories about this place, so I think it's a good idea to make an album of this trip as a family heirloom." This account indicates two characteristics of event photos: social meaningfulness of the event itself and people's role in the event. The event itself did not have any formal nature compared to a wedding ceremony, for example. However, the place had a great emotional relevance for the family. The account hints at the roles of people in creation of these event photos. It showed how several persons were taking photos on the trip, how the uncle was guiding the group and their photo-taking activities and how the group agreed to collect photos from all sources to create an album.

Reciprocity was seen as central to the idea of collectivism. An interview participant (#6) mentioned about her trip to Norway, where all the six friends had a camera with them. During the trip each of the members took photos and at the end of the trip they decided to share all the photos. After reaching home, our participant (#6) created a Picasa account where she shared her photos from the event and invited others to share their photos. Figure 5 shows a screenshot of that participant's Picasa gallery. One can see 6 different albums from the same trip uploaded by the 6 friends who went on the trip together. In this case the authorship and ownership of the photos were shared. This was one of the few cases where such an open reciprocity was shown.

Fig. 5. A Picasa gallery screenshot.

In several cases, however, participants sent and received only selected photos via emails or via online photo galleries. Some participants even raised a concern about not receiving interesting images from the people who were on the same trip. Highlighting this fact, one interview participant (#11) commented: *"If you don't collect your photos just after the event finishes, most likely you won't get the photos later."*

5 Discussion & Implications

In this paper, we have used the notion of 'event' as a lens to understand different practices related to domestic photography. Event photos emphasize the social meaningfulness and the dynamics of events. We found that the nature of events, to a large extent, shaped the motivations and practices surrounding domestic photography.

The notion of sharing in private groups emerges from our observations: when a group of friends or family members take part in a social event, they often collaborate and share their photos during events and even after the events. The roles of individuals became visible in the activities of taking event photos, for example, the 'assumed' and 'assigned' role of photographers in an event. The plurality of photo-takers shows how they cooperate and exchange photos with each other. While capturing event photos, people are motivated towards documenting an event, keeping in mind its social order of the event (e.g. wedding); they also make sure that they have every individuals' photos taken (e.g. group photo); and particularly focus on significant or iconic moments from events. As a drawback, they often end up with segmented photo collections with a lack of shared knowledge about photos captured by different people. We observed that often one person took the responsibility of making sure that photos were shared. But such reliance on explicit user actions was time consuming. As we noted from our results, it is difficult to keep track of photos taken by different people during a trip or event. The case discussed in figure 5 seems to be the best-case scenario where everyone is obliged to send their versions of photos. It may not always be easy to share photos once the event is completed. Asking for these photos again and again from individual photographers might even affect social relationship of people.

Our participants were cautious about how they shared photos to a large audience. For event photos, private channels such as email or links to secured photos (e.g. Picasa) were preferred over SNS such as Facebook and Google+. Important photos were printed in different forms (e.g. postcards, albums) to convey a sentimental value associated with such event photos.

Existing literature on domestic photography focuses on aspects such as storing and sharing [13], photo work issues [16], storytelling, identity and other personal aspects [9, 27]. Our findings provide directions for designing event sharing tools for mobile devices. In the following, we will lay down directions for design.

5.1 Event Sharing and the 'Cloud'

Smart phones with built-in cameras and other sensors have become a pervasive commodity these days and their hardware features and capabilities will only increase over time. Considering events in private or public space, a likely scenario is that more than one person will be able to take photos using their camera phones. We believe that by using cloud computing infrastructure new services can be designed that will allow users to share their experiences.

Following the notion of private groups, photo sharing services can be developed that could allow creating private groups while being at an event. Others can join in through ad-hoc group formation using NFC or Wi-Fi connections. All the users in a particular photo group can take photos and store them in a shared repository on a cloud, which is accessible to all the members. We can think about several possibilities for allowing automated photo sharing features that can replace the manual transfer and sharing of photos. For example, specific sharing features can be included that allow automatic sharing of photos only to those friends who were part of a particular event, disabling others to see those photos. Additionally, using advanced face recog-

nition features, photos can be shared only to the people whose faces appear on the photo.

Novel services could also allow users to 'broadcast' their interests for specific images, where a user is notified whenever a new photo of him/her appears on the cloud, for example. This way, if the user's photo appears in the album of a complete stranger, the user can request that photo. On the other hand, she could be enabled to declare not to appreciate capturing, or sharing such photos in public domain. Users can subscribe to specific entities of events (e.g. locations, people) and get notifications of new photos when they are captured. The features discussed so far are only a few possibilities. Depending on the nature of the event users should be able to choose or define such features taking their privacy concerns into consideration.

Capturing and analyzing meta-data becomes very important in such cases. Meta-data associated with photos, such as date and time, GPS coordinates, names of recognized people or objects in the photos, orientation and activities of photo-takers, and nearby users and services can be useful for analyzing certain activities and behaviors of users. Especially, the usage meta-data (e.g. how often one visits a photo, what kind of photos people look at, which circles or groups these people belong to) can be of great value, as users' consumption of photos can produce new content that can be very valuable for enhancing social interactions via such event sharing tools. These systems require a careful design approach by taking into account users' privacy concerns. Participatory design approach used in [30] could be a useful way to take into account these concerns at an early stage of design.

Once group members share their photos in a cloud repository, the service can constantly analyze such new content for making better recommendations to its users. For example, based on the existing content about an event, the system might be able to suggest which photos are redundant or which type of photos are still needed for a complete capture of the event. Based on the photos that are already taken by other members, the system might inform and recommend users about different activities that are going on simultaneously. In this case, photos can be the raw source of information and through its detailed analysis, important notifications may be generated.

5.2 Ideas for Event Sharing services

We envision that photos and photo sharing activities can support navigation, tourism, gaming and other comparable domains. We believe that capturing useful meta-data from the smartphone and photos can lead to innovative applications and services being created.

Domestic photography has always been a social process. New technologies can make domestic photography participatory and cooperative by involving people in the event as well as outside of the event in peer-supported navigation. The participant in our home visits session (#1) gave an interesting instance of how he and his family members went to visit a village in Russia where the participant's father was born. This instance illustrated how peers (uncle) and certain objects (old photos) could support navigation. Elaborating on this observation we envision how the use of maps and location-based services can inform users where to go for capturing interesting photos

in a tourist area. Google search already provides location-based image search, however, the aspect of real-time assistance may be worth exploring further.

There are existing augmented reality applications that allow cameras to detect and recognize buildings and other relevant objects. In addition to image recognition, GPS coordinates and activities of the photographer can be detected and utilized to further refine accuracy of locations. In such a way, meta-data of photos and photo collections can be utilized as 'check-in' mechanisms. For tourism purposes, an idea of shared-itineraries (figure 6) can be explored: a service that keeps track of photos taken by its subscribers and stores them with reference to location, time and other metadata and automatically generates itineraries based on these data. This way, the subscribers leave cues about their visits whenever they take photos. Over time, several categories of itineraries will develop. New subscribers can make use of such itineraries by looking at the navigation path, photos and other relevant information. Companies such as Expedia or Lonely Planet could enhance their customers' tourism experience using such services.

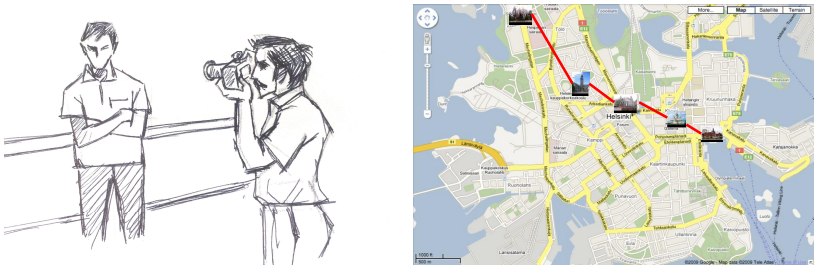

Fig. 6. Shared Itinerary concept. As subscribers take photos on their visit, itineraries are generated automatically on maps.

Photos from multiple sources could be used for providing novel location-based services: Concert organizers or amusement park owners could implement services that make use of photos from visitors who subscribe to such services. Amusement parks for children may consider search and rescue services. A cloud-based infrastructure may be utilized to collect photos of a missing child from photo streams shared by different visitors as well as from security cameras of the park. This way the system can learn a child's roaming behavior and his/her whereabouts. An example concept could be where a dynamic 3D panorama image is generated depicting the child's visit in different areas of the park sorted by time-stamps. Additionally, this system could be enhanced by services such as Google Maps or Twitter.

5.2.1 Designing for Significant Moments

In our findings, we observed that the appreciation of photos by our participants was related to the 'significance' of photos. This seems true for any type of photos. However, it was rather difficult to generalize what made a photo significant, because the significance or value of a photo was strongly context dependent. The photo shown in

figure 3a was significant because of the nature of the event and people who were in that photo, whereas the photo in figure 3b represented a shared-experience and an iconic moment that made that photo significant. It would be of great value if we could design technologies or tools that could determine significance of a photo, utilizing its meta-data. One way to extract significant photos from multiple sources in an event is by analyzing similarities in photos from multiple cameras.

Fig. 7. Plurality of photo-takers; and a graph of number of photos taken by people in an event over time, highlighting the most similar photos.

Figure 7 shows a concept for exploiting the plurality of photo capture. Here, users can subscribe to a social event (e.g. rock concert, social gathering) where several people are taking photos. Users may be physically present at the event or using this service from a remote location. The concept allows users to get the most significant photos from that event in real-time. The system can collect photos taken during the same time-frame and location and make a comparison to find similarities in photos, using face recognition and/or object recognition. When such photos match with each other, then the most representative photo is identified and shared to all the subscribers of that event, as a significant moment of the ongoing event. The system can constantly look for such photos with user-generated significance (i.e. plurality of photo takers) and send these photos to the subscribers. The example graph in figure 7 illustrates how photos from multiple sources can be extracted by matching their similarities. In fact, Xerox has already developed a concept where a photo album is created in real-time from multiple sources by taking into account the plurality and similarities of photos [8]. Such an invention allows users to get the most important photos from that event in real-time.

6 Conclusions

In this paper, we provided an account of practices that surround event photos. We aimed at looking explicitly at events in order to elicit ideas for developing tools that can support event sharing via mobile devices. We believe that even though the idea of event photos is not new, our specific focus on events drew some interesting insights into the specific characteristics of event photos and how these photos are dealt with by users. Based on a field study, we developed our analysis of event photos and photo sharing paradigms focusing on four major themes describing practices surrounding

event photos: 1) representing events, 2) significant moments, 3) situated activities through photos, and 4) collectivism and roles of participants. Keeping in mind the growing pervasiveness of sensor-based smart camera phones, our findings are aimed at exploring concepts and design ideas for event sharing applications.

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