Exploring Design Concepts for Sharing Experiences through Digital Photography

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Abstract. In this research, we aim to explore meaningful design directions for future photography applications with a focus on the experiences around sharing. We review a wide-range of photo-related applications, extracting emerging patterns of different photo-related interactions to inform a framework for their discussion. We extract two themes from the first stage of our analysis: contextual annotation and tangible representation, and then examine interesting application ideas around those themes. We categorize design ideas into four groups: augmentation of photo taking, editing as creating new memories, building new social networks through photo sharing, and tangible representation to mediate intimacy. Finally, we present user reactions to our design ideas. In addition to providing a framework for describing different photography applications, this work provides an example of an integrative approach to designing new sharing experiences through digital photography.

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1 Introduction

Photography has become an increasingly important part of everyday life due to the development of digital media. Digital camera popularity has driven the creation of new applications and devices, such as digital photo-printers, digital photo-frames and various kinds of photo-editing software. Sharing photographs has been popularized through websites and multimedia message services. While photographs have played a social role for decades, digital photographs and networks have enabled more widespread sharing, leading to the appropriation of photographs for other uses [18], such as building social networks [28, 29] and communication through images [21]. In this research, we explore new design opportunities and challenges to enrich intimacy and emotional bonding by re-interpreting the overall experience of photography with new digital technologies.
1.1 Approach

Rather than solving specific user needs or interface problems, we focus on creating new user experiences. Our study consists of three phases of exploration: 1) develop a framework of photo applications, analyzing existing applications within the framework, 2) generate conceptual ideas, focusing on sparse areas within the framework, and 3) evaluate conceptual ideas through an exploratory user study. Each step of our study provides implications for potentially interesting design directions [Fig1].

![Fig. 1. Process of Concept Exploration](image)

We first reviewed a number of photo applications covering capturing, editing, displaying and sharing photos. Based on this review, we extracted patterns of emerging design concepts, which we fit into a framework of photo applications. This framework enabled us to identify potential design directions, which imply opportunities and challenges for developing new applications. Second, we generated several design concepts by specifying potential design directions. Realistic limitations or practical user needs were not seriously considered, but the implications from the potential design directions provided insightful guidelines to generate these ideas. Then representative ideas of each group were introduced as specific design scenarios, which we defined interesting design directions. Lastly, we conducted an exploratory user study to investigate how users actually use and think about photographs, and to get feedback about the proposed design scenarios. This iterative concept exploration provided meaningful design directions, which could be considered further for developing experimental prototypes or practical application in future work.

1.2 Objectives

Photography has various purposes, including practical information recording, emotional memory reminding, and professional artistic activities. In this research, we focus our analysis on the interpretation of digital photography around sharing moments and memories. For example, taking photographs for the purpose of making special memories with others, editing photographs for making further stories, synchronized displaying for enhancing intimate awareness, and more. The final output of this research (a framework of overall photo applications, conceptual design scenarios and feedback from user studies) will provide insights for designing future photo-applications that can enhance users’ sharing experiences.
2 Primary Study

2.1 Digital Photography

Research about digital photography is diverse, from practical managing and searching of photos to conceptual applications in dynamic multimedia environments such as the Manhattan Story Mashup project [26]. Several projects suggest practical design implications for photo management applications based on a thorough investigation about how users really archive, edit, and share photographs [9, 11]. Although we do not focus on issues of photo-management in this research, it is a practically significant issue, and their research provides us a fundamental understanding of overall process of photo-works, practical user needs, problems and technical solutions. Kindberg et al. explore potential uses of camera phones and suggest corresponding design and technological issues [16, 17]. After gathering abundant user data-the pictures users take with camera phones or receive from others-they categorize different contexts and purposes of using camera phones to envision future design directions and technological considerations. Their research also provides us with a better understanding of social interaction through mobile camera phones, which serves as an insightful starting point for our study.

2.2 Sharing Experiences

Research about emotional and affective user experiences for daily life is a more fundamental motivation of our study. Bill Gaver conducted experimental design projects to explore new use of awareness technologies [10]. Those design projects address new sensory and interaction possibilities as well as a wider range of emotional relationships, which is quite different from the predominant research focusing on improving system efficiency and usability. Frank Vetere et al. employed cultural probes, contextual interviews, technology provocation, and participant observation as effective methods for designing technologies to mediate intimacy in everyday [25]. Both of those studies pointed out that designing technologies for intimate awareness tends to include evocative materials and literary metaphors and that innovations of intimate use of technologies are not in the application or system but in the dynamics of use. In terms of the dynamics of mutual experience, Battarbee introduced the concept of co-experience, which is created by users in the course of using designed artifacts through social interaction [3]. With several examples of co-experiences such as creating and sharing experiences with multimedia (particularly MMS with camera phones) and communicating context, he suggested three dimensions of co-experience: explorative-organized, synchronous-asynchronous, and creative-interpretive. Jodi Forlizzi and Battarbee presented the concept of ‘co-experience’ as the process of creating meaning and emotion together through product use in relation with other types of subjective and individual experience [7]. They studied how individuals’ experience or their interpretation of experience is influenced by the physical or virtual presence of others. The research ultimately implies that interactive technology systems can play a large role in supporting co-experience through providing communication channels and the possibility to create, edit, share and view content with others.
3 Framework of Photo Applications: potential design directions

We analyzed various photo applications from already popular ones to conceptual research ideas. We then positioned each application concept or group of similar applications into an overall framework [Fig.2].

![Fig. 2. Framework of Photo Applications](image)

We distinguished those applications into three groups: 1) already established application groups (marked in light gray circles), 2) recently popular application groups (marked in bigger deep-gray circles) or specific applications that are thought provoking rather than popular (marked in smaller deep-gray circles), and 3) academic research concepts (marked in white circles with dotted lines). The horizontal axis of the framework represents overall procedures of photography - capture, edit, display, and share. Although management of photography (archiving and organizing) is an important part, we do not consider it in this study because it is deeply related with technical issues of searching and retrieving. Also, it should be noticed that the procedures are not necessarily a linear process, but are performed in an iterative fashion. The vertical axis represents the continuum of digital and film photography, because we consider digital technology as an influential factor that has brought significant changes to the photography experience.

With this framework of photo-applications, we aim at finding emerging patterns of new application concepts in relation with established application groups. Specifically, we put film cameras, paper photo albums and photo frames as typical application groups for film photography. Digital camera, digital photo-editing software and photo-sharing websites are established application groups of digital photography. Now, we will analyze some patterns we inferred from this framework. These patterns suggest opportunities and challenges in developing future application concepts.
3.1 Analysis of Emerging Patterns

Overall, it is noticeable that more application concepts have been proposed for editing and sharing photographs due to the benefits of digital technology. Accordingly, features of editing and sharing have been added to the very basic features of digital cameras, thereby extending the notion of a camera. For example, camera phones and multimedia messaging services have been popularized, enabling pictures to be uploaded to websites at the spot of capturing. Even networking-enabled cameras have been proposed [8]. These augmentations to the photo-taking device mean that sharing becomes an important part of the photography experience with digital technologies, whereas printed pictures were the only ways to share pictures with film photography.

As digital cameras and online communication become popular, photographs are not only shared with friends, but also with strangers. Sometimes sharing itself generates new stories more than reminding people of previous memories captured by the photographs. For example, photo-sharing websites such as Flickr have been an important gate for socializing [29]. Photo Tourism implies possibilities of new social relationships among unknown people who are mediated through an experience of visiting the same place [23]. This project suggests a system for browsing large collections of photographs in 3D, with large collections of images from either personal photo collections or Internet photo sharing sites as data sources. People may feel sympathetic to each other because they traveled to the same place and their pictures collaboratively build a new 3D virtual space, even though they do not know each other at all.

Editing can become more integrated with photo-taking when done on the spot within a camera rather than with computer-based software afterwards. A lomographic camera is a film camera which captures movements of objects as consecutive images or adds visual effects to a picture directly through a lens filter [20]. One concept of context photography is a digitalized version of Lomography by distorting an image according to movements of objects or background sound [12, 13]. Through user studies, researchers found that this new concept of photography augments the experience of taking photos, making the experience more pleasurable for some users-more than capturing the situation, some users are more active in order to make an interesting photo effect. New editing features like this can stimulate active social interaction among participants compared to passive and static capture of moments. Photosmart series cameras automatically adjust images of people so that they look thinner or prettier to make them more satisfied with their pictures to be shared [6].

Digital photo frame is a relatively new application group to display digital photos outside computer monitors. As sharing photos through camera phones or websites becomes more popular, digital photo frames can also be used for sharing pictures. For example, Flickr Photo Frame is directly linked to photo-sharing websites, or connected to other frames for distant display sharing [25]. The patterns of spanning and converging features of digital photo applications have been more significant in academic research. For example, Cherish is a concept of a smart digital photo frame, which supports seamless accessing, sharing, and displaying pictures at home [15]. Living memory box aims at developing a holistic personal digital memory system in ubiquitous computing environments [24]. It addresses the overall process of collecting, archiving, and sharing various multimedia content, including photographs and video clips, as memorable stories.

Digital photography, however, does not always allow new features or generate new experiences compared to film photography. As it is mostly viewed from computer screens, some tangible or graspable aspects of displaying and sharing are largely missing. Some applications partly compensate for this lack of tangibility. Some digital photo frames play background music according to changing pictures [11]. Lumitouch supports awareness by lighting up a remote photo frame when a user touches the local frame [5]. Snow globe displays a random photo upon shaking [4]. However,
these approaches are rare and allow limited user engagement. While one piece of old film photograph tells more than its image with its traces accumulated over time (e.g. the shabby paper, faded color, and messages or scribbles on the back), digital photographs lose the meaningful traces as well as the authentic value of memory. Metaphors of film photography could be borrowed as interesting interface concepts for displaying and sharing digital photographs.

3.2 Implications for Potential Design Directions

Now we suggest potential design directions from the analysis of emerging patterns of photo applications. Those implications do not consider practical user-needs or specific contexts of use at this stage. We focus on the re-interpretation of user experiences with digital photography around sharing moments and memories [Fig.3].

1) Augmentation of photo taking
According to the extended features of digital cameras, the meaning of photography can be augmented to capturing contextual factors other than visuals and to capturing natural moments rather than static and aesthetic views. This new concept of photo taking is expected to enhance co-experience with those who are not present at the photo-taking moment, as well as to stimulate more interaction among those who are present.

2) Editing as creating new memories
Due to the characteristics of digital media, editing is relatively easy for digital photography and the meaning of a picture can evolve through editing. People, even though they are not included in original pictures, can be a part of specific pictures by adding notes or graphic elements. This implies that editing can enable new kinds of social interaction as an independent activity in a photo’s lifecycle.

3) Building new social networks through photo sharing
With the popularization of online photo sharing, people can easily access others’ personal photos, even if they don’t know each other. Also with its ability to tag location, photos can connect strangers in a certain environment with its practical information. This new type of social network and various collections of photos can be a useful resource for building new experiences.

4) Tangible representation to mediate intimacy
A photograph reminds the viewer of people who appear in it, even of the viewer who was not present at the moment of capture. If photographs can deliver vivid contextual factors beyond static visuals, it will increase sympathy between the viewers and those who appear in the photo. Tangible representation of those contextual factors may increase intimacy among those who share the picture.
From those implications above, we come up to two design themes, *contextual annotation* and *tangible representation* of photography. First, we focus on context as an important theme, whether it is for sharing contexts remotely with others or for reminding information and memories from old photographs. It suggests several research questions, like which contextual factors should be included in photographs to provoke intimacy among people, and how the photos can be annotated for sharing and displaying. Second, tangible media is another important theme, especially on connected with how to convey the previously described contextual annotations. This theme suggests further research questions about what kinds of tangible media should be employed for appropriate representation of contextual information and how different emotions can be caused from various tangible, ambient, or physical interfaces.

### 4 Idea Generation: interesting design directions

The themes from potential design directions served as insightful guidelines of idea generation for future photo applications. We explore specific design ideas for every potential design direction introduced above: augmentation of photo taking, editing as creating new memories, building new social networks through photo sharing, and tangible representation to mediate intimacy.

#### 4.1 Augmentation of Photo Taking

This concept suggests a new direction for digital photography in which people’s casual activities are captured in spite of themselves. Including ideas of capturing moments according to various contextual stimuli like sound or movement as well as having pictures taken remotely by others, this body of concepts aims at enhancing co-experience through shared contextual factors. This concept may encourage people to
actively engage in interaction with others to get more interesting images. Also, people may feel certain moments are more meaningful if they are easily captured and shared with others as a reflective story. Example scenarios are shown in Table 1.

Table 1. Augmentation of Photo Taking

<table>
<thead>
<tr>
<th>A. Context-Sensitive Camera: what if photographs could be automatically taken according to contextual factors such as sounds or movements as stimuli?</th>
</tr>
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<tbody>
<tr>
<td>B. Remote Camera: what if a friend of yours could take photograph of you from somewhere else and vice versa?</td>
</tr>
<tr>
<td>C. Story-Making Camera: what if your everyday life would be captured as photographs, while you don’t realize, collected, and then shared with others as a meaningful story?</td>
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</table>

4.2 Editing as Creating New Memories

This concept emphasizes the value of editing photographs to create further memories that can be shared together. Including ideas of editing on the spot within a camera as well as accumulating traces of editing overtime, this body of concepts aims at increasing intimacy among participants through creative and pleasurable photo editing. Example scenarios are shown in Table 2.
### Table 2. Editing as Creating New Memories

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<tbody>
<tr>
<td><strong>D. Photo Collage Camera:</strong></td>
<td>what if you could make a photo collage by combining several different scenes together at the moment of taking pictures rather than taking the scene as it is?</td>
</tr>
<tr>
<td><strong>E. Co-Photographing:</strong></td>
<td>what if you could combine or compare different scenes that your friends are viewing from separate cameras at the moment of taking pictures?</td>
</tr>
<tr>
<td><strong>F. Digital Photos Live:</strong></td>
<td>what if history of editing and sharing pictures could be traced and then visually influence on the picture?</td>
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### 4.3 Building New Social Networks through Photo Sharing

This concept suggests a purposeful use of photo sharing. Including ideas of connecting people though a collection of their photos and reinterpreting the role of a digital camera as an information appliance that can generate and access visual information, this body of concepts aims to facilitate public access of personal photos and practical information exchange among strangers. Example scenarios are shown in Table 3.

### Table 3. Building New Social Networks through Photo Sharing

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<table>
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<tr>
<td><strong>G. Information-Sharing Camera:</strong></td>
<td>what if you could save and search for location-based information while looking certain views and objects through camera?</td>
</tr>
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</table>
4.4 Tangible Representation to Mediate Intimacy

Photographs have played an important role to mediate intimacy among families or friends by reminding of shared memories. Including representation of contextual annotations as well as subtle distortion of digital photos according to the context of display or viewers’ response towards the picture, this body of concepts aims at increasing intimacy through tangible representation of memories. Also, the picture frame can be reinterpreted as a meaningful interface for tangible manipulation of images. It focuses on the importance of continuous communication with others through synchronized photo display. Example scenarios are shown in Table 4.

**Table 4.** Tangible Representation to Mediate Intimacy

- **J. Contextual Photo-Display:** what if digital photos would be displayed according to specific contextual factors or emotional status that provoke previous memories?
K. Ambient Photo-Frame: what if the color of digital photo frame would change according to the counts of viewing or downloading in relation with photo-sharing websites?

5 Evaluation of Ideas: meaningful design directions

We conducted an exploratory user study to find out how people use photographs and to obtain feedback about proposed application concepts. The study consisted of three parts. First, participants were given a questionnaire about what kinds of photo-applications they use, from cameras, photo-editing software, photo-display devices, to photo-sharing websites. Second, they freely described several of their personal photos that we had asked them to bring to the session. The purpose, situation of photographs, and the reasons why they liked or disliked the photos were main topics participants covered. Lastly, we briefly introduced specific user scenarios of our photo-application concepts and asked them for feedback based on their previous experiences. The study was conducted with a total of 10 participants in 3 small focus groups. Each session took about 2 hours.

5.1 How people use photographs

Most participants’ photos reminded them of people and places. The majority of pictures brought to the study sessions (15 of 19) were selected as the participants’ favorites because those pictures represented a story or memory about people and/or places. A few (4 of 19) were selected because of their beautiful colors or composition regardless of the meaning of subjects. In the case of landscape or object photographs, the images sometimes appeared much nicer than reality, causing participants to have a more favorable memory about the situation. In the case of portrait photographs, participants were very conscious about how they looked (i.e. skin tone, body outline, facial expressions, etc.).

We found that photo-sharing websites are so popular that they greatly influenced how participants manage their photographs. Some participants regularly post their personal photos to their websites, while others enjoy browsing and downloading interesting pictures from their friends’ websites. Regardless of whether they actively manage a photo-sharing websites or not, all participants highly valued the importance of such websites for being connected with others. One of the participants commented, “Flickr [29] made me to take pictures, it has most of my memories of my recent life.” Another participant appreciated Cyworld [28], a Korean online community, since she thinks that it helps her to keep in touch with friends as well as makes her regularly write a private photo-diary. Some participants were very conscious about others’ comments and counts of viewing or downloading, which often generated further relations and stories beyond the original photo itself.

At times, the influence of photo-sharing websites on intimate relations was quite controversial. One participant pointed out that expanded social networks through
easily accessible online photo-sharing may mean nothing to intimate relationships, or can even limit the quality of candid relationships. For example, when people gather for a party, it becomes common to pretend excitement and to make exaggerated gestures and expressions just for getting impressive photos to be posted on websites, rather than truly enjoying that moment with friends. Also, since people can individually check on how their friends and families are doing through their photos on websites, people may make excuses for not keeping in touch with others in person. Some participants were even worried about the decreasing quality of candid relationships in contrast to the rapidly expanding social networks. This implies that linking highly accessible online outlets for sharing personal photographs to meaningful relationships might be an important research direction.

5.2 Feedback about conceptual ideas

We selected three of the application concepts introduced in Tables 1-4 and constructed specific use scenarios around traveling to a new city. Although the application concepts were purposefully vague, we hoped to get valuable comments and insights based on participants’ relevant experiences by providing detailed descriptions of contexts:

**Scenario 1) Sharing location-based information through cameras**
Sarah is lost during a trip to Paris. She doesn’t want to look at a big paper map on the street like a stranger. She hopes that she could just walk around without worrying about being lost and easily get information about new places. Also, it would be interesting to trace back other people’s experience through annotated information. What if location-based information could be shared through cameras?

**Scenario 2) Communicating through cameras**
She finally arrives there. She wants to make her own story with pictures of the place, which are distinguished from typical tourist pictures. She wants to send her friends e-postcards with pictures that she takes. Also she thinks it would be exciting if she could make an interactive storybook with her friend in real-time. What if digital camera could be used also as a communication device?

**Scenario 3) Enhancing intimacy through photo display**
After coming back from the trip, she uploads some pictures on Flickr, and displays several pictures in her digital photo-frame. It would be interesting if she could share the experience with her friends through more tangible interaction. What if a photo-frame could represent contextual factors that can be share with others?

Participants considered it interesting to combine a camera with a location-based information device. They also suggested a possibility to create meaningful information, by recording their path of travel (as images with location tags) and then sharing it publicly. This can provide a more sympathetic experience with others as well as practical information. This type of information sharing can help people feel connected with others, even if they don’t know them. It was pointed out, however, that people might depend too much on devices and miss the chance to explore the real world and to interact with people around them.

Sharing context enables co-experience with others even from a distance and a camera is an appropriate device to deliver vivid contextual factors. Participants showed much interest in the concept of “interactive story book”, which adds more personal messages to images from the camera. Sharing context and narratives was thought to
be better if it occurs in real time. However, participants remained skeptical of this remote sharing because of the possibility of isolating people from their physical environments while being virtually connected with others.

Tangible representations of digital photos have the potential to enhance memories and to mediate people in affective ways. Most participants agreed that although they enjoy taking pictures, they do not fully enjoy most pictures afterwards because they are usually accessible from computer screens. If pictures were easily presented in physical environments, the memories would be more readily enjoyed by individuals and shared with others.

Beyond the discussion of the three scenarios, participants gave brief feedback for the overall application concepts in Tables 1-4. Generally, participants felt negative towards concepts about context-sensitive photography (A) because they are not familiar with matching sound or motion to still pictures. Participants showed much interest in the concepts of information-sharing camera (G), people-identifying photographs (I), and ambient photo-frames (K). Reactions to the concepts about sharing and co-editing photography and being taken picture by others were generally positive, as long as copyrights (for E and H) and protection of private information (for B and C) were seriously considered.

6 Conclusion

In this research, we analyzed emerging patterns and developed a framework for describing photo applications. Although the analysis did not consider user needs or problems from the start, they were implicitly reflected in the course of finding relations between new technologies and trends of application uses. We then generated conceptual ideas for potential design directions, focusing on areas in the framework which were sparsely populated. By doing this idea generation before a user study, we expected that the conceptual ideas would not be limited to current user needs or problems of specific application interfaces. The intent was for the proposed ideas to provoke further discussion about users’ desire for future photo applications. Finally through exploratory discussions, we derived meaningful design directions that can be used to consider practical application development. Although this study is about exploring future application concepts, it is not directly related to technical innovation nor does it provide specific design solutions. Our approach is more to explore the space for innovation, with an emphasis on meaningful user experiences [19]. We expect that the framework of photo applications, conceptual idea generation and the discussion to provide a more integrated perspective for designing new sharing experiences through photography with new digital technologies.

References

