The Social Uses of Personal Photography: Methods for Projecting Future Imaging Applications

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ABSTRACT

An important problem for technology design is predicting users and uses for emerging technologies—doing user-centered design for users and uses that don't yet exist. The primary contribution of this paper is in presenting a method for anticipating future uses of new technology by looking at users' higher-order motives or activities for current and emerging technology. We identify three high-order motives or "social uses" for personal photos: constructing personal and group *memory*; creating and maintaining *social relationships*; and *self-expression and self-presentation*. We then articulate design implications for digital imaging technology with an emphasis on networked programmable mobile imaging devices, especially cameraphones.

Author Keywords

Activity theory; social construction of technology; personal photography; digital imaging; digital photography, mobile imaging; camera phones; photo albums; photoblog; bodystorming; projective design.

ACM Classification Keywords

H.5.1 Multimedia Information Systems – evaluation/methodology; J.5 Arts and Humanities – Fine arts; H.5.2 User Interfaces – user-centered design

INTRODUCTION

An important problem for technology design is predicting users and uses for emerging technologies—doing user-centered design for users and uses that don't yet exist. This is especially true in the case of mobile media technology and applications, in particular cameraphones, which are undergoing rapid growth and transformation. Designers of mobile media technology and applications in industry and academia need new methods to project and design for future uses and users of mobile media. To address this challenge, we have developed a theoretical framework and method for uncovering the "social uses" of personal imaging technology that will enable us to understand: what factors will condition the migration of existing behaviors from film to digital cameras and future cameraphones; the adoption of emerging uses of digital cameras and cameraphones by current camera users; the emergence of new uses of digital imaging and cameraphones; and the resistance to these migrations, adoptions, and future uses.

We use the term "social uses" to describe the higher level motives that guide the specific actions that users perform. For example, while we may observe that a user performs the action of emailing a photo to family members, this action (i.e., "what" the user does) is not the same as the motive informing the action (i.e., "why" the user does it), in this case to maintain the social relationship. This distinction is crucial because current actions will not necessarily be good predictors of future actions due to the fact that different actions can satisfy the same motives, and as technology changes, so does the set of actions available to users. By discovering the motives guiding current user actions, we hope to project and design possible future actions and artifacts that may satisfy the same enduring motives. Furthermore, our focus on the resistance that users express in using current personal imaging technology helps us both to uncover the social uses which are struggling to find satisfaction within the set of actions shaped by current technology and to project how to better match future technology to these social uses.

Our social science research has uncovered three significant social uses of personal imaging technology which designers of imaging and mobile media technology need to understand and design for: constructing personal and group *memory*; creating and maintaining *social relationships*; and *self-expression and self-presentation*. These social uses and the associated findings from our social science research have significant implications for mobile media technology design and inform our development of design methods aimed at projecting and designing for future uses and users of mobile media technology.

Virtually everyone is affected by personal photography. Even people who rarely take pictures do so on vacations and at important life events. Most people are photographed and receive photos at some point. Photos are of great sentimental value and irreplaceable: often the one thing that people rush to save when their house burns is their photos.

Developments in personal photographic technology, then, are potentially significant to large majority of the population, including people who may otherwise make

minimal use of new technologies. Digital photography and the internet are the most significant change in photographic technology and practices since George Eastman introduced the film camera and the institutional structure for developing and printing pictures that made amateur photography possible.

The work reported here is part of our research and development of next-generation mobile imaging technology and applications. In Fall 2003, we built and tested a cameraphone photo annotation prototype that leverages spatio-temporal context, social community, and user interaction at the point of capture to infer media content [12, 33, 37].

We see a unique opportunity for HCI research to help shape the design of an emerging platform for multimedia computing that will have a profound impact on the lives of millions of people around the world by making possible the daily and ubiquitous capture and sharing of personal photographs. Beginning in the first half of 2003, cameraphones outsold digital cameras worldwide. Within the next decade cameraphones may become the predominant consumer imaging device. These developments present a great opportunity and challenge for human-computer interaction design. How are designers to project these future users and uses? We assert that without understanding and designing for the social uses of personal imaging technology—not just *what* people do with current imaging technology, but *why*—the future promise of mobile imaging may not be realized.

In this paper, we present an analytical perspective that is useful for theoretically-informed research on the emergent uses of new technology and apply it to the domain of personal photography and emerging networked digital imaging technology and show some of its implications for the design of this and other emerging technologies.

The primary contribution of this paper is in presenting a method for anticipating future uses of new technology by looking at the variety of users' higher-order motives or activities for current and emerging technology. We then demonstrate this approach in our work identifying a robust set of social uses of personal photos. Our premise is that users are always most interested in how technology helps them in their own ongoing concerns and practices, which may or may not have been anticipated or targeted by designers.

RELATED RESEARCH

Photo Management Software

In the HCI literature, much of the work related to personal digital imaging has focused on designing interfaces and systems to manage personal photo collections through assigning keywords [24], innovations in temporal clustering [18] and spatial indexing [36], data visualization [3], or to facilitate photo sharing [1]. Unfortunately, much of this innovative interface design work was not connected to in-depth research into how people use photos and was only validated by assessing users' performance on narrow tasks.

Ethnographically-Informed Photo Application Design

Several projects have empirically investigated the organization of images and the uses of digital photography as a source of information for design. Frohlich et al. [14] interviewed eleven families in their homes about their activities involving digital photos or prints. Frohlich et al. classified what people did with their photos along spatial and temporal dimensions—"here" versus "there" and "now" versus "later"—creating four categories: "remote sharing," "sending," "archiving," and "co-present sharing."

Rodden and Wood [32] gave thirteen subjects digital cameras and software for organizing digital photos, and analyzed their use of both prints and digital images over a six-month period. While these papers' findings (which we don't summarize here for reasons of space) are generally consistent with our empirical findings, they do not account for recent changes in photo behavior brought on by cameraphones and photoblogging, and focus predominately on low-level actions (what people do) rather than on high-level activities (why they do it).

Ethnographic Methods

Ethnographic methods and other socially-informed approaches to understanding and designing for users and their needs and contexts have been of growing importance in HCI in recent years [5, 21]. Most such efforts, however, have focused at what we describe below as the action, not activity, level—asking *what* people do, not *why*. Oulasvirta [28] and Gay and Hembrooke [15] are among those who have recently attempted to develop approaches that are more tied to needs or motives. Our purpose here is to continue this exploration into ways to understand and formulate and recognize the more enduring motivations that people seek to fulfill by means of (among other things) technology.

Projective Design Methods

To try to understand future uses of technology, recent studies have used projective and performance-based methods. These "projective design" methods enable designers to literally embody their prospective users in actual or simulated use contexts. "Informance design" uses scripted performances to enact personas and scenarios [9]. Designers at IDEO define "experience prototyping" generically as "any kind of representation…that is designed to explore or communicate what it might be like to engage with the product, space or system" [8]. Simsarian, also of IDEO, differentiates "role playing" as a method that requires "vivid and focused exploration of […] situations" and use of the "entire body" to generate ideas (also referred to as "bodystorming") [34]. Oulasvirta et al. [28] have been applying bodystorming techniques to ubiquitous computing application design. Iacucci et al. [20] has applied projective design methods to enable users to experience and project

possible technology uses. Participants in their study carried a "magic thing" (a non-interactive low-fidelity prototype) throughout their day in a variety of contexts. Participants were told the magic thing had the functionality of future devices and were asked to note down uses that occurred to them in real world contexts.

What these projective design methods have in common is an emphasis on some type of embodied, situated experience as a critical way of creating empathy with users and their behavior, understanding the various scenarios of use, and the discovery of unanticipated behaviors and uses to support the generation of ideas for design solutions. While these "projective design" approaches are especially helpful in enabling designers and users to embody potential user actions in context, they need to be augmented by our method of uncovering the larger social uses which motivate these actions in order to provide a generative framework for guiding design and interpreting the results of these projective design methods. Oulasvirta's "humanistic research strategy" [28] has similar goals to our own "social uses method," but while his strategy focuses on "individual needs," ours addresses activities and motives within and across social groups.

Visual Studies

Of course, people have been taking amateur photos at least since George Eastman introduced film cameras and processing in 1880. The field of visual studies encompasses visual sociology, visual anthropology, and other fields that are concerned with the use and creation of images [2, 30]. While much of its focus is on mass media and other public images, one subdomain is concerned with "vernacular" photography as a form of visual communication, and with the content and social processes of family photos. "What can we learn about ourselves as social and cultural beings through studies of the photos we make about and for ourselves?" [10]. Some key insights from visual studies that have contributed to our analysis include:

- Photos have both content and materiality. The material of photos increases the ease with which they can be torn loose from their original context and take on new meanings.
- Any photo has multiple meanings. Photos have both public and private meanings.
- Meanings are socially-constructed by both the maker and viewer, and, some say, the subject, in the context of larger issues and practices of meaning-making.

OUR APPROACH

Our approach draws on and, to some degree, synthesizes and extends two analytical approaches: activity theory (AT) and social construction of technology (SCOT). Both have value in understanding the interaction of people and artifacts, and both emphasize that use and users are situated in a place, time, and community, and a pre-existing network of practices and understandings.

Activity Theory

A key principle of cultural-historical activity theory [13, 25] is that activity is structured hierarchically. Activity theory distinguishes between short-lived, goal-directed, concrete, conscious actions and higher-order, durable, motivated activities. At a lower level in the hierarchy are operations, which are largely automatic. Actions become operations when they become unconscious, such as shifting gears in a car.

A single activity may be composed of multiple actions, and an array of alternative actions is possible for any one activity (Figure 1). People engaging in the same actions may be trying to accomplish different activities, or different actions may be aimed at the same activity; and over time the actions that satisfy a given activity may be replaced by other actions.

Another central principle is the mediating function of tools or artifacts (which may be physical objects, or non-material, such as classification systems, procedures, methods, and laws). Artifacts are deeply intertwined with practice, with how people actual do what they do, both reflecting and shaping external and internal actions and activities. The design of a tool and the knowledge of its use—which, in AT, is a crucial part of the tool—carry social knowledge across time and place. Nardi [26] contrasts this with the notion of affordances, which treats artifacts as more easily separated from social practices.

Activity systems are culturally and historically situated; they are strongly intertwined with their context. As such, they are also highly variable and dynamic, changing as conditions change.

One of the major purposes of activity theory is to make visible the everyday practices of work. Engeström [13] distinguishes AT from ethnographies of work, which, he says, investigate actions, without asking what motivates people in their work. AT has been used in HCI largely to help understand context and practice, especially as part of a design process, often with an emphasis on the mediating function of artifacts [6, 15, 22, 27, 31].

We borrow from AT its emphasis on the user's goals or motives; the variable relationships among activities, actions, and operations; the community and the cultural setting; and the mediating role of artifacts. AT reminds us that people may choose among alternative actions for the same purposes—or have alternative purposes for the same actions. In trying to understand how people's actions may change with changes in technology, it is helpful to ask what more stable, enduring activities or motives are behind people's actions, and how people may adapt their actions to achieve those ends as conditions change.

Figure 1. Activity Theory's Hierarchy of Action

Social Construction of Technology

Social construction of technology (SCOT) [4, 29], developed in Science and Technology Studies, contends that the "working" of a technology does not inhere in the technology but is socially constructed.

Key elements of SCOT include relevant social groups, interpretive flexibility, and stabilization or closure. Interpretive flexibility means that a given artifact may have different meanings (or uses) for different groups. These meanings are constrained but not determined by the design; they are created by users as they match the possibilities of the technology to their problems or desires. A relevant social group is a group that shares an interpretation of a technology. A technology becomes stabilized (however temporarily) when varied relevant social groups find that it solves multiple problems (Figure 2).

The key explanatory move in SCOT is to show how a technology gets adopted and its design stabilized (however briefly) when multiple groups find it a workable solution to one or more of their (often differing) problems. Bijker [4] showed how the design of the bicycle varied over 50 years before it stabilized into its modern form. For example, rubber tires were considered funny-looking, but were accepted by the young men who wanted racing machines because they were fast and by the people who wanted bicycles for transportation because they were comfortable.

SCOT has its limitations, but overall it has provided effective post hoc explanations for why some technologies have succeeded and others failed. Our approach is a kind of reverse SCOT. We argue that, to make projections about whether and how people are likely to use an emerging technology and to optimize the design accordingly, we need to understand people's activities, goals, and problems, and then consider how the technology in question may fit.

Gay and Hembrooke [15] describe a SCOT-inspired approach to a project designing hand-held technology for museum visitors. They recruited museum professionals, designers and vendors, and museum patrons to evaluate ideas for functions to incorporate in handheld devices for use in museums. This departs from the traditional SCOT approach, as does our work, by being oriented toward the design of new technology rather than seeking a post hoc explanation of technology stabilization. The most important difference between our approach and Gay and Hembrooke's is that they began with a design task and engaged stakeholders in identifying and evaluating functionalities for the technology. In AT terms, they were looking at actions. Our approach, on the other hand, begins with an inquiry into people's activities.

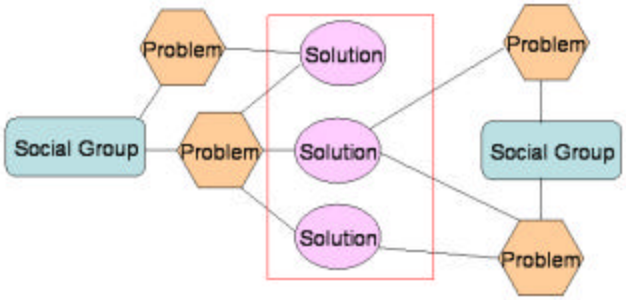

Figure 2. SCOT's Process of Technology Stabilization by Relevant Social Groups

The Social Uses Approach

Inspired by cultural-historical activity theory and SCOT, our approach has been to identify a set of higher-order activities that we are calling "social uses" by means of grounded theory [16]. Rather than imposing the researchers' pre-existing framework on the data, grounded theory, like ethnomethodology, privileges the participants' own understandings and interpretations. Grounded theory then generates theoretical categories and their properties from empirical observations in an on-going, iterative process of data collection and analysis. Sampling is controlled by the emerging theory, continually extending the investigation to groups that are likely to extend the emerging theory. The goal is not to get a statistically valid sample, but to seek data that will help to deepen, extend, or challenge the emerging conceptual framework. We departed from pure grounded theory, however, in acknowledging that others have studied people's photographic practices, and incorporating observations and interpretations from visual studies that are consistent with our findings—and questioning our findings when they are inconsistent with others'.

With this approach we then can project future scenarios that may support users' actions that satisfy these consistent activities and motives in new contexts and conditions. In

Figure 3. Illustration of Applying Social Uses Method to Projective Design

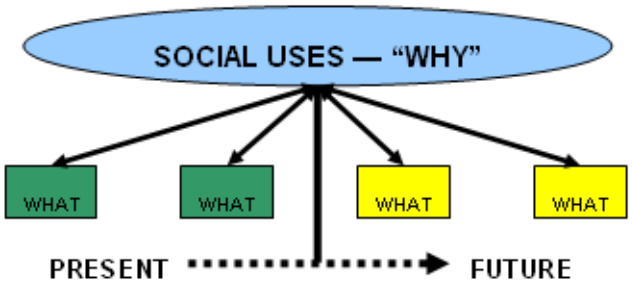

Figure 3 we depict the conceptual structure of our approach: we move from ethnographic observations of what users presently do to the higher-level social uses that motivate these actions, and then move from these enduring social uses ("why" users do things) to projected future actions ("what" they may do in the future).

Grounded theory is dynamic, always ready to accommodate new findings. We don't argue that our list of social uses of photos is complete, universal, or permanent: it is our best approximation based on the evidence available to us. Nor are we attempting to be predictive. Instead, we are trying to project future actions based on current observations. Human action is underdetermined; we cannot predict how people will behave. Activities, however, are more stable and enduring, slower to change, than actions.

DATA COLLECTION

Our data reported in this paper come primarily from a series of interviews with casual photographers. In addition, we have collected data from several other sources, which we draw on in this paper.

Through informal channels, we identified participants who had been taking pictures for at least a year; had used their present camera for at least six months; and took a minimum of about 50 pictures a year. We did not require that they used digital imaging technology; all but three did, though many were far from avid digital users. The digital users' computer skills ranged from quite sophisticated to minimal (although all had access to a computer).

We interviewed a total of 21 people about their photo technology and their practices of taking, sharing, annotating, retrieving, and using photos. Since much personal photography revolves around family, we sought a mix of people with and without children. Most interviews were conducted in the participants' homes and lasted about two hours. We asked them to show us their cameras and photos. We videotaped the interviews, and took both video and still photos of their cameras, photos and photo storage, and the photos displayed around their home.

Eight subjects owned cameraphones and made at least some use of them. Of those, three used cameraphones extensively and did not own another imaging device. The rest used cameraphones occasionally. Only five of our formal interviewees so far routinely place their photos online. Our campus human subjects process forbids us from interviewing our own students so, while we have a large pool of photobloggers (including several of the authors) with whom we are having informal conversations, this group is currently underrepresented in our interviews. In addition, we conducted two focus groups of seven and eight graduate students in information management and systems to discuss their image capture, storage, sharing, and retrieval habits [37].

We systematically examined over 100 publicly accessible photo collections, ranging from 10 to 5000 photos, and informally viewed many, many more. It is of course impossible to design a valid probability sample of public photo sites, so these findings are impressionistic and anecdotal rather than a statistical survey. We investigated the kinds of photos people post and how photos are organized and captioned. Finally, we have been informally observing and photographing people taking pictures in public places, primarily tourist photos.

RESISTANCES AND AFFORDANCES OF PERSONAL MEDIA

If understanding image-related activity helps us to understand people's adoption of new technology, it should help us to explain their resistance to it, emerging new uses, and other surprising observations. In particular, we highlight here two surprising findings from our empirical work: participants' attachment to printed photos, and their resistance to recording metadata (i.e., descriptions of photo content and context). These two areas of resistance, which might have been seen as unreasonable or ill-informed, are understandable when we consider the social uses to which people put images. Specifically, these resistances involve the importance of the *materiality* of photographs and the *orality* of photo sharing.

Materiality

A major theme in our interviews was the extent to which participants relied on prints, even prints of digital images. Both formally displayed and casually scattered prints enabled ambient and spontaneous encounters with images. A search for one print often turned up others of interest. Prints themselves show their age and history through their visible and tangible wear and their importance through framing and placement.

Participants generally found prints easier to annotate and treated prints as more precious and less easily discarded than electronic images. When asked about digital photographs, some participants praised the ease of copying them and sharing them with remote family and friends, but expressed fears of digital transience.

The importance of photo albums also revealed the importance of materiality. Many participants felt obligated to organize their photos into albums for the benefit of family, friends, and their future selves, and expressed guilt when they inevitably fell behind. Those who didn't create albums said that they "ought to" or "definitely planned to."

A notable exception to participants' attachment to prints is

younger, technically-savvy users who use web-based tools such as photoblogs for sharing photos.

Orality

Another significant finding in our study was the central role of face-to-face oral communication in our participants' use of photos, and their general lack of interest in assigning metadata and making annotations. The act of sharing photos was as much (if not more) about talking with family and friends as it was about looking at photographs. Oral communication seemed to serve first and foremost the function of maintaining social relationships, but also was often the primary mode of intergenerational transmission of memory and identity.

The combination of orality and materiality makes sense in terms of the social theoretic emphasis on objects as organizing activity, discussed below. The photo acts as an object; the photo's detailed metadata exists (with few exceptions) primarily as interpersonal and intergenerational conversations. While participants acknowledged that relying on oral transmission of personal and family knowledge often resulted in tragic loss of information, in their daily lives the affordances of text or recorded audio for capturing photo metadata did not seem to satisfy their deep needs for intimacy, immediacy, and connection that face-to-face oral communication offers.

Emerging Uses

This social use framework can also help explain why some emerging technologies are encountering resistance or gaining acceptance. Photoblogging is increasing in popularity we believe due in large part to its ability to serve the social uses of memory, creating and maintaining relationships, and self-expression. Annotation software (such as Adobe PhotoShop Album or our own Mobile Media Metadata prototype for photo annotation on cameraphones [12, 33, 37]) face consumer resistance not merely due to the complexity or difficulty of annotation, but because of the primarily social function of photo sharing. Possible solutions to this resistance include greater automation, incorporating metadata into the flow of social uses surrounding personal photos, and seamlessly creating metadata as a byproduct of these uses.

SOCIAL USES OF PERSONAL PHOTOS

In this section, we develop our set of social uses of personal photos. When relevant, we compare our findings to others'. Sontag's [35] work deserves special mention. A work of cultural criticism based on the history of professional photography in the US, it is quite different from our study. We did not begin with her analysis when we did our grounded theory analyses of our interviews. However, as we are not the first to investigate personal photography, we find her analyses often a useful validation of our interpretations.

Constructing Personal and Group Memory

A major theme in the interviews was the role of photographs in memory, personal and collective. Images are particularly powerful in evoking memories. In our interviews, favorite images were usually spoken of not in terms of the quality of the image but of the memories and emotions evoked.

The assumed realism of the photo gives it the aura of being a simple record of a true event, a slice of life, which belies, of course, the power of the choices made by the photographer. A photo is always a frozen moment in time, and so viewing a photo is not only a step backward in time, but an encounter with mortality. "Photography is an elegaic art, a twilight art...All photographs are *memento mori*. To take a photograph is to participate in another person's (or thing's) mortality, vulnerability, mutability" [35], p. 15.

We found that family events and family members, especially children, were frequent subjects of personal photos. People who had taken other kinds of pictures often took nothing but family when children came into their lives. People place a particularly high value on photos of children as a way of capturing key moments and also the changes in their children over time. Some parents apologized to us for being "bad parents" who did not take "enough" pictures of their kids.

The meaning of many photos is dependent on their being a part of a narrative. When photos are organized into a sequence, such as in an album or a weblog, they are organized to tell a story. Photos are a way of creating a narrative of one's own life, and of a group or family.

Respondents often enjoyed reminiscing over their own photos. However, viewing photos is often a social event. Sharing photos, especially face-to-face, was extremely important to many of our respondents.

"[The personal photo] seems heavily reliant on verbal accompaniment for the transmission of personal significances. Photographs presented to others are typically embedded in a verbal context delineating what should be attended to and what significances are located in the image, and providing contextual data necessary for understanding them." Musello 1980 p. 39 quoted by [11], p. 76.

One of the resistances that we noted above is to annotation. When people did annotate photos, it was generally simple, primarily date and place, sometimes names of people represented, and sometimes a humorous comment or explanation of why they took the photo.

Why this reluctance? Clearly, manual annotation takes time and effort. But we found a reluctance beyond that, which we surmise is due to two possible reasons. First, writing down a story is not the same as real-time *telling* a story. Telling the story allows the teller the pleasure of reliving the event. And it gives him or her control over the narrative, which may change depending on the listener, the mood of the teller, or other circumstances. These narratives are situated and interactive: they are tailored to the audience

and conditions. Real-time storytelling also has the ever-present possibility of dialogue and a more intimate social exchange.

Second, photos are encounters with our own mortality as well as others'. Annotation is a way of admitting and inscribing the fact that we won't always be around to tell the story ourselves. We interviewed a 98½ year old great-grandmother and her daughter, neither of whom was especially worried that the older woman was the only person who knew the identities of many people in her extensive collection of family photos. When we asked the great-grandmother why she did not annotate her photos, she replied: "I have already *told* people who they are; if they want to know they can come ask me."

Tourist photography is a major genre of personal photography. Travel is often a significant part of the individual's or group's life story, and photos are often a critical element. One person said, half-joking, that she had no pictures of Machu Picchu and thus no "proof" that she had been there. Tourism can sometimes be seen as a process of acquisition of photos to take home [35]. Some respondents cited the value of photography for how the process of photography (as opposed to the artifact of the photo) brings them closer to experience: looking more carefully at a scene for its photographic potential may deepen their attention and connection to the sight. Others, however, saw photography as potentially objectifying and reducing the experience. One of our respondents who had both traveled and photographed extensively stopped taking pictures for a while, because he feared that photography got in the way of experience.

Creating and Maintaining Social Relationships

Photos reflect social relationships, but they also help to construct and maintain them. They may do this through their content, how they are used, and the process of photography itself.

The act of viewing pictures together is important in reinforcing relationships; sometimes because of the shared stories, sometimes simply from the shared experience. Cameraphones and email make possible photo-sharing-as-messaging: as information exchange, or simple connection, "like a kiss or a hug," as one participant explained.

People place a particular value on photos of people. Photos are a way of being present with people not present, however temporarily. Parents frequently keep pictures of their children in their offices or use them as screensavers. One participant told us that she has pictures of her son in her office, not at home, because her son is at home. Parents routinely send frequent pictures of children to their grandparents.

In this presence-at-a-distance, the print, especially the framed photo, is potent. An 80-year-old woman described her conversations with the framed print of her late mother that she keeps in her living room and carries when she travels. Recent news photos show parents of children killed in terrorist attacks clutching framed pictures of their children. Sontag claims that it is not only "primitives" who see the image as capturing some part of the person: "It is also a trace, something stenciled off the real, like a footprint or a death mask" [35], p. 153.

Photos as gifts—often framed, highly personalized, symbolic gifts—reinforce relationships. Again we see the power of the physical image: people readily deleted photos received as email attachments, but would almost never throw away even poor quality printed photos received from friends and family through the mail.

Photos of families and friends do not only chronicle key events. They both represent and support a sense of shared history and shared identity. Cronin [11] and Bourdieu [7] both argue that photo albums, in particular, do not simply contain but create personal and family histories. The posed family or group, the choice of pictures and their captions, the narrative structure of the album, the events depicted, all construct the story of the unified, happy family. Who gets included (e.g., in wedding pictures) identifies who is in the family or "the gang." Photoblogs often do the same; one young person's website was introduced with the text, "If you're here, you know you're loved." Interviewees spoke of giving their children a sense of family by viewing family photos and telling family stories.

The prevalence of posting photos on the internet—via email, commercial services, or blogs and webpages, for a closed group or not—is growing. People talked about the value of easy sharing with distant family and friends, including giving viewers the choice of which photos to download or print.

Relationships are not just with one's own social group. Some tourists talked about photography connecting them with locals, the process of taking the photo and/or sharing the image with the subject (via Polaroid or viewing on digital camera) opening the door to conversations with locals.

Another aspect of relationship is power. Some speak of the lack of agency of photographic subjects, their lack of control over how they are portrayed. In critiques of tourist photography, this is a particular issue: the paternalism of seeing locals as "quaint," or the moral dilemma of creating aesthetically-pleasing images of poverty.

Digital photography is changing this in contradictory ways. Some photographers use the instant review function of digital image capture devices to show subjects their images and delete those to which subjects object. Koskinen et al. [23] observed groups using the LCD display to compose group portraits. On the other hand, photos can be easily emailed and posted to the internet and distributed widely.

Self-Expression, Self-Presentation

These two activities are related but different. While self-expression is about giving voice to one's unique view of the world [35] self-presentation [17] is about influencing others' view of oneself. One obvious way that photos function in self-presentation is through self-portraits, and, by extension, pictures of one's friends. Personal web pages and blogs, especially, for our purposes, those containing photos, are powerful tools of self-presentation. Some photos taken by US soldiers in Iraq and posted on http://www.yafro.com/frontline.php, for example, show determined groups of soldiers with their guns.

Less directly, by sharing one's images, the photographer is showing people what kind of person he or she is: someone who engages in a particular activity; has traveled here or there; has friends, family, or pets who look like this; has this kind of a sense of a humor; these photographic skills; or this aesthetic sense. Sometimes chat group participants represent themselves to other participants, not with self-portraits, but with pictures of their rooms, their desks, prized possessions—any number of visual representations of "themselves."

Self-expression has more to do with the aesthetic and humorous nature of some photography than with its content or its reflection on the photographer. Contemporary Western culture places a high value on the individual's unique view of the world and the expression of one's personal aesthetic sense, and therefore on the artist. Photography helps us both to look at the world more carefully and thereby see it differently, and to express our individual perspectives.

A significant development in photoblogging and related uses of the internet is the posting, often for viewers at large, of photos whose significance is not in the content as much as in their aesthetic quality. The internet makes it possible for photographers to reach a much larger and more varied audience than ever before with images that are meant to be artistic or humorous—creating their own photo galleries.

DISCUSSION

Our approach, derived from SCOT and activity theory, has been to look for the motives or activities for which people use personal photographs, at the relatively stable practices and understandings associated with photography as it has existed to date, and the emerging practices and understandings associated with digital technology, especially networked and mobile digital imaging. Our contention is that this approach is generally useful for designing new technology: rather than focus on people's concrete actions and operations, as is usually the case in design and usability studies, we argue that useful technology matches users' motives.

People use photos for memory, for creating and maintaining social relationships, and for self-expression and self-presentation. The media used, the content of photos, and how people display, share, organize, and archive photos vary depending on the social use. The result is not a neat correlation; we can't create a table showing which medium, for example, best suits a particular social use. However, the uses help us to understand some of our observations and project and design future imaging applications.

Implications for Socially-Informed Methods

The findings here show the value of a social uses, motive-based approach to understanding people's choices of technological and other means of reaching their goals. More generally, these show that HCI can benefit from an exchange with other fields concerned with people's activities and with technology, including Science and Technology Studies.

Implications for Projective Design Methods

Our social use approach provides a grounding framework for projective design methods to better project future uses and users. In order to understand which possible future actions a user might be motivated to engage in, we need to articulate the connections between these actions and the social uses they might serve. A given artifact or feature may be "easy-to-use" but not "useful" if the actions users perform do not satisfy their motivating social use. Furthermore, these possible relations between social uses and actions help articulate a generative design space connecting activities and motives (which are enduring) with a range of actual and possible actions that might fulfill them, and conversely, a given action may be imagined to serve differing social uses.

For example, if we posit that photoblogging is an action that largely meets the social use of self-expression, and online photo albums primarily serve to maintain social relationships, projective design methods can explore a space of possibilities: 1) What other actions might better meet these same social uses (for example, online photo albums that support real-time voice conferencing and shared control of the real-time viewing of the networked photo album to support real-time verbal storytelling and guided photo sharing at a distance)? 2) What if the concrete actions of photoblogging or using online photo albums come to primarily satisfy other social uses? (For example, what if photoblogs would better support creating and maintaining social relationships if they had better access control, allowing access only by tight-knit social groups?). This approach to creating a generative design space of social uses and projected future actions can help generate and ground and the interpretation of the results of embodied exploration and imagination of possible future mobile media applications.

Implications for Mobile Media Applications Design

Based on our findings, we make several recommendations for the design of future systems for managing digital photos. Unlike prints, digital photos are often perceived as highly impermanent. Most of our subjects feared losing

their digital photos due to computer problems and this fear limited their reliance on digital images. Even some of the more technical subjects who backed up their photos on CDs and multiple hard drives felt uncertain about the future of those images. The importance of this problem is especially clear if we consider that support of memories is one of the key social uses of photography. Creation of a *trustworthy and enduring* data repository would potentially ease those fears. Note that such a system would need to both *be* reliable and *seem* reliable. While networked storage may seem like an easy solution, it would fail to take into account the importance of the *materiality* of photos and enduring objects. Instead, we would suggest designing a family "photo safe"—a fireproof, waterproof physical storage device with an internal backup system that a user could keep at home. For additional security, several such devices could replicate content on other machines on the internet, so that the data of a grandma's photo safe is replicated in the children's machine.

Perhaps the most important social role of photography is building and maintaining social relationships. Among other things, printed photos provide support for face-to-face interactions among friends and family. Gathered around loose prints or bound albums, people tell stories and reminisce about shared experiences. In contrast, the current digital practices we observed appear to be skewed towards remote and asynchronous sharing. This creates several challenges for design. First, we need to understand how to design devices that support face-to-face interactions around digital prints. (Balabanovic [1] attempted to do just that.) Second, we need to understand how to take advantage of the ability to quickly share photos to support remote yet synchronous sharing. Subjects in the study by Frohlich et al. [14] reported that people talked on the phone while jointly looking at photos, yet to the best of our knowledge no system was designed to facilitate such sharing.

The use of digital photos for self-expression and self-presentation is currently inhibited by the difficulty of managing social context in the digital world. Self-presentation is attuned to specific audiences. Printed photos allow for such management by making use of social norms associated with physical space (e.g., strangers usually won't go into the bedroom and will thus not see photos displayed there) and control of access to prints is thus built on top of control over access to physical spaces. Photos placed on the web, however, are much harder to control. They are typically either shared with the whole world or protected with a password—an inflexible mechanism that requires *a priori* decisions about who should and who shouldn't see them. Sending photos by email gives the owner more control, but is described as inconvenient by the recipients. A more flexible approach for managing access to digital images would also support the maintenance of relationships allowing the users to share images with their family and friends more easily without fear of presenting their images to a wider or inappropriate audience.

In addition, several design implications arise from the resistances we observed. The resistances that users express in relation to technology may not simply be matters of "ease-of-use" but of more profound resistances to the mismatch between the technological medium and existing social uses. The social uses of memory and relationships rely on the importance of the materiality of photographic artifacts and the orality of narrative discourse around these artifacts. These findings mean that the immateriality of the digital medium itself on the one hand and the mediation of digital recordings (whether textual or verbal) on the other face resistance in relation to the primary modes in which people currently address basic social concerns.

FUTURE WORK

We are planning new studies of social uses to inform our design methods and technology development. We will continue to do interviews, revisiting some demographic groups and broadening the involvement of others such as photobloggers. We will especially observe real-time photo-sharing activity. We will continue to mutually inform our social science and technology design research by using our social uses approach to guide our technology prototyping and using our design process and field trials to help us uncover and better understand the underlying social uses for current and future imaging technology. To that end, in October 2004 we will deploy and study the use of our second-generation Mobile Media Metadata cameraphone and web applications that integrate photo sharing and annotation with 60 users over several months.

We also plan to explore and develop additional projective design and prototyping methods that involve users in the design of new photo technologies, including technology probes [19] and "magic thing" studies [20], to better understand the interaction of various technological affordances and resistances with the social uses of personal imaging technology.

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Presents a method for anticipating uses of emerging technologies by identifying higher-order activities, then applies it to personal mobile imaging. Helps practitioners anticipate how users incorporate technologies into their lives.