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From "What?" to "Why?": The Social Uses of Personal Photos

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ABSTRACT
To predict the uses of new technology, we present an approach grounded in science and technology studies (STS) that examines the social uses of current technology. As part of ongoing research on next-generation mobile imaging applications, we conducted an empirical study of the social uses of personal photography. We identify three: memory, creating and maintaining relationships, and self-expression. The roles of orality and materiality in these uses help us explain the observed resistances to intangible digital images and to assigning metadata and annotations. We conclude that this approach is useful for understanding the potential uses of technology and for design.

Categories and Subject Descriptors
H.5.1 [**Information interfaces and presentation (e.g., HCI**)]: Multimedia; H.5.2 [**Information Interfaces and Presentation (e.g., HCI)**] User Interfaces - *User Centered Design;* H.4.3 [**Information systems applications**]: Communications Applications; H.3. [**Information storage and retrieval**]: Information Search and Retrieval

General Terms
Design, Human Factors.

Keywords
Mobile camera phones, social uses, photography, social construction of technology, science and technology studies, multimedia, orality, storytelling, digital imaging, metadata

1. INTRODUCTION
Current trends in design focus on users' needs, activities, and contexts. However, user-centered design is most feasible when there are current uses and users for whom to design. 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. In this paper, we present an analytical perspective that is useful for theoretically-informed research on the emergent uses of new technology.

This paper presents findings from an ongoing study of the social uses of personal photos and how these relate to current and future uses of imaging technology. We demonstrate how the approach described here has shaped the interpretation of our findings. The primary contribution of this work is in: (1) presenting a method for anticipating future uses of new technology by looking at the *social uses* of present technology, in this case, personal photos; and (2) identifying a robust set of social uses of personal photos. Among the surprising findings are that the materiality of printed personal photos is important to many of their social uses and that the social functions of face-to-face oral interaction help explain consumer resistance to photo annotation.

The work reported here is part of our research and development of next-generation mobile imaging applications. We wish to understand how better to design applications for future programmable, networked, mobile imaging devices (especially cameraphones). Cameraphones outsold digital cameras worldwide in the first half of 2003 and are predicted to offer five megapixel resolution by 2008 [26]. From their technical features (accessible operating system, application APIs, and wireless networking) and economic advantages in the US market (subsidy by wireless service providers), cameraphones may likely emerge as the primary imaging device for consumers in the next decade. However, 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.

The current study seeks to uncover underlying social uses of imaging technology that will enable us to understand what factors will condition the migration of existing behaviors from cameras to future cameraphones, the adoption of emerging uses of cameraphones by current camera users, the emergence of new uses of cameraphones, and the resistance to these migrations, adoptions, and future uses. We have built and tested a cameraphone photo annotation prototype that leverages spatio-temporal context, social community, and user interaction at the point of capture to describe media content [11, 35, 40]. The current study grows out of that research and our desire to develop a methodology and growing body of knowledge that can interpret current social uses of imaging technology to better inform the design of next genera-

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tion mobile imaging devices and applications.

A common theme in the HCI and CSCW literatures has been a call for more socially-informed research (e.g., Dourish [12]). While CSCW in particular has tried to incorporate an understanding of the social in design (e.g., [2, 12, 13]), many practitioners still find themselves without guidance in understanding users. Our approach is an effort to remedy this. Our work is inspired by several current approaches to knowledge and work in social theory, but not completely identified with any one approach. Our argument is that our approach is useful, which we illustrate with the example of our work on the social uses of personal photos. The analytical perspectives that inspire our approach stress the interpretive flexibility of technology, the variety of motives for human action, and the importance of the material and cultural contexts for action. Our premise is that to understand whether and how people will use—or resist—new imaging technology, we need to understand how they might interpret the new technology and use it to accomplish their activities. We investigate not just *what* they do with current technology, but *why*.

In the rest of the paper we discuss related work in personal imaging technology studies and systems (Section 2), methodologies for understanding social uses of technology (Section 3), our study and its findings (Section 4), the underlying social factors we have discerned that condition the use of imaging technology (Section 5), and their implications for the design of future imaging technology (Section 6).

2. PRIOR RESEARCH

In the HCI literature, much of the work related to photography has focused on designing systems to manage personal photo collections through assigning keywords or innovations in clustering and visualization [5, 16, 23, 32] or facilitating sharing [4]. Unfortunately, much of this 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.

Attempts to understand photo use have been made in other fields. Greenhill [17] investigated the role of photography in supporting family narratives. She discussed the functions of phototaking and sharing, in particular photos' non-communicative functions as part of childrearing and the enjoyment of holidays. Unfortunately, Greenhill's findings were based on in-depth interviews with just one family. Chalfen [10] studied what he called "Kodak culture," examining 200 collections of personal photos. By asking interviewees why they think people take photos he identified three functions of photography: documentation, memory support, and definition of cultural membership. These early studies, however, lacked interest in the *design* of imaging technology and with the advent of digital photography and mobile imaging in the last five years new research is warranted.

More recently, Frohlich et al. [14] studied users' needs with the aim of informing technology design. They studied eleven families, using a combination of ethnographic field observations, interviews, and diaries to ask what people do with conventional and digital photos. People tried to arrange their best photos into albums, but they were unable to keep up with the backlog of photos. People preferred sharing prints in person to looking at the computer screen with other people. Frohlich et al. classified what people did with their photos along two dimensions, here versus there, and now versus later, creating four categories: "remote sharing," "sending," "archiving," and "co-present sharing."

Rodden and Wood [34] 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. Again, participants attempted to organize prints into albums, but often fell behind. Some wrote captions on the back of the photos, but most only labeled the envelopes. People tended to keep digital photos organized by a "roll" of photos taken around the same time. Some organized digital photos into albums, and assigned captions to individual photos, but many just labeled the "rolls." Rodden and Wood observed that photos tended to be of special events, such as holidays or weddings, and were taken to remember the events and were often discussed with friends and family. While the latter two papers contribute greatly to our understanding of how people use photos, they focus predominately on low-level actions (what people do) rather than on high-level activities (why they do it).

A more activity-centered analysis is presented by Okabe and Ito [30] who have been studying the uses of mobile devices including cameraphones among young people in Japan. They conclude that the ubiquity of cameraphones is creating a "new kind of personal awareness" and changing the nature of the images that get captured—they are more likely to be casual, immediate moments of beauty or interest. We borrow some of their methodology, but apply it to the social uses of personal photos in general with the aim of informing the design of digital imaging technology.

Photos are not the only kinds of information artifacts that people share for social reasons. Marshall and Bly [24] looked at how people share "clippings," physical or electronic—e.g., posting articles on bulletin boards, emailing news items to people, cutting out published pieces for later use. They concluded that much of the sharing served social functions beyond simply informing, including: establishing mutual awareness; educating or raising consciousness; using common interests to develop rapport; or demonstrating knowledge of the recipient's unique interests.

These studies have described actual use of existing technologies. To try to understand future uses of imaging technology, recent studies have used projective and performance-based methods. Iacucci et al. [21] had participants carry a "magic thing" (a non-interactive low-fidelity prototype) through 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. While this approach is helpful in eliciting potential user actions, it is not focused on uncovering the larger social uses in which these actions are situated.

Others have looked at social goals as a way of understanding emergent uses of new technologies. Mynatt et al. [28], comparing physical and virtual communities, note that actions in one didn't "translate transparently" to other, and so one should "focus on the social goals of the activity in relation to the affordances of the online environment" (p. 136).

In sum, much of the work in HCI on imaging technology is concerned with technology for managing photos. Imaging behavior has also been studied in the social sciences. To project the future uses of new technology, however, describing people's current actions is insufficient. The approach represented by Mynatt et al. and Marshall and Bly stresses looking at the social uses of a current technology to anticipate the existing social uses that a new technology may fit.

3. SOCIAL THEORY APPROACHES

We draw on a number of socially-informed approaches to understanding human activity We will first describe briefly three such approaches, and then discuss common elements in these and related analytical perspectives that inform our approach. Finally, we describe the approach taken in this study.

Activity Theory has been used in HCI to help understand context, situation, and practice [1, 19, 33]. Nardi [29] describes activity theory as having three main concerns: consciousness, the asymmetrical relationship between people and things, and the role of artifacts in everyday life. The stress on consciousness means that behavior cannot be understood without reference to the user's intentions which are related to current material and social conditions. Artifacts are mediators of human thought and behavior. They carry a history of social practices, of how people do things as well as how they understand, and therefore have a large role in shaping users' behavior and understandings. The specific material form of artifacts is significant for, among other things, how they carry culture and history, and interact with embodied action.

Activity theory has a precise framework and terminology for describing the relationships among "object" (that which is being transformed, which may be material or immaterial, e.g., a plan), subject, activity, action, operations, and tools. Since our goal is not to use activity theory as our governing framework but as a generative approach, we can simply say that specific actions or tasks can only be understood in terms of higher-order motives, intentions, or activities. A variety of actions are possible for any higher-order activity, and a variety of activities may motivate any action. A person taking a picture (an action) may be engaged in any number of activities. It's impossible to understand the user's activities or goals by observing her actions, and we cannot understand actions without understanding the user's intentions or activities. Because the emphasis is on users' own understandings, the methodology of activity theory is largely ethnographic.

Distributed cognition (DCog) [19, 20] has also been used in HCI. While activity theory is largely concerned with the individual, distributed cognition is largely concerned with the distribution of cognitive activity across individuals. Both approaches are concerned with the distribution of activity between the human and non-human, people and their tools. DCog addresses how artifacts shape as well as are shaped by how people think, see, and understand; and, like activity theory, how the study of (cognitive) activity cannot be separated from the history of material artifacts and social practices. Halverson [19] describes both DCog and activity theory as seeing "the world of artifacts, personal history, culture, social, and organizational structure through a filter that labels them as the residue of collaborative cognition, analyzed along numerous time scales" (p. 246).

The field of Science and Technology Studies (STS) [38] shares with HCI a concern for the relationship between the social and the technical. With a few exceptions [2, 37, 39], however, there has been little crossover between STS and CSCW. One analytical perspective within STS is Social Construction of Technology (SCOT) [6, 7]. SCOT has been used to explain after the fact how a given technology eventually gets stabilized. A key element of SCOT is interpretive flexibility: a given artifact may have different meanings (including uses) for different groups. This meaning is constrained but not determined by the design and is created by users as they match the possibilities of the technology to their problems or desires. A successful design is used by multiple relevant social groups for varied uses. In a classic SCOT study, Bijker [6] showed how the design of the bicycle varied over 50 years before it stabilized into what we would recognize today. The "young men of nerve and means" who wanted racing machines and the people who wanted bicycles for transportation both accepted rubber tires, for example, which proved to be both comfortable and fast.

Resistance occurs when the design—or the policies and practices of the designers or operators of the technology—does not fit the intentions and activities of its users. Kline [22] reports that when phones were introduced in rural America, the telephone companies tried to define eavesdropping and joining into others' conversations as rude, because n-way conversations drained the companies' batteries faster. However, these practices fit the community's prior practices of casual group socializing and helped relieve the isolation of farm residents. They 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.

SCOT and related approaches have 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 conjecture about whether and how people will use emerging technology and to optimize the design accordingly, we need to understand people's prior social activities, goals, and problems, and then hypothesize about how the technology in question may fit these conditions and be adopted, or fail to fit and be resisted.

4. THIS STUDY

4.1 Conceptual Framework

For our approach, we draw on several elements common to social constructivist approaches to human action. First, these approaches posit a "seamless web" of technology and the social, politics, and economics. Second, they stress ethnographically-informed methods that seek to understand participants' own interpretations [8]. Social constructivist and ethnomethodological approaches assume that social institutions are actively constructed by ordinary members of society in their moment-to-moment, improvisational solutions to practical problems. These situated approaches give an important place to practice, people's actual, daily, embodied actions, including their interactions with others and with resources, including tools, which carry a history of prior social uses and understandings. Artifacts both shape and are shaped by users' understandings. They are not just extensions of human action; they are intimately involved in the construction of action and meaning and its persistence across time and place.

Our contention is that to understand how people will use new technology, we need to look, not just at what they do with current technology, but why. Then we can ask how new technology may fit those motives, goals, and practices, the entire interdependent matrix of action, artifacts, meanings, practices, and social relations, and how it might be designed to better exist within and support them. Other research has asked what people do in capturing, storing, retrieving, and using images. Our concern is why. It is possible, even likely, that with changes in technology people will use personal photos for purposes other than the current ones, but to begin with it is useful to look at the current purposes or intentions of use.

Asking people "why" is sometimes useful but not sufficient. Their answers are likely to be at the action level rather than the activity level. And, as ethnographic research posits, people are often unable to articulate exactly what they do and why. At the same time, we cannot ascribe our reasons to their actions. Our approach, therefore, is ethnographically-informed, consisting of interviews with people, observations of their photos and photo use, and projective questions about possible use scenarios freed from current technological constraints in order to uncover social uses.

4.2 Goals of This Study

Our primary concern is the social uses of personal photography: the reasons people take photos, the kinds of photos they take, what they do with them afterward (including which photos and how many photos they keep, whether and how they assign metadata, including captions and annotations), and where and how they store photos. We were also especially interested in their photo sharing practices: with whom, how, when, and what kinds of photos they share with others. From this we derived a set of the social uses of personal photos. The purpose of this study was both to identify these uses and to test the approach of seeking social uses to explain observed and reported actions.

4.3 Methods

The data reported in this paper come primarily from a series of interviews with casual photographers about their personal photography, including analog camera users, digital camera users, and cameraphone users. In addition, we have collected data from several other sources, which we draw on in this paper. 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. We examined a total of 20 publicly accessible photo collections, ranging from 10 to 5000 photos. The collections included personal photo albums focusing on friends, family, and events, a genealogical album with photos of ancestors, portfolios of serious photographers, and individual and collective photoblogs with and without themes.

Through informal channels, we identified willing study 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. We interviewed a total of 13 people about their practices of taking, sharing, annotating and retrieving, and using photos. Since much personal photography revolves around family and especially children, we sought a mix of people with and without children, but we found that some of our "singles" still took many pictures of the children of friends and family. We interviewed: five individuals without children; two individuals (one single, one married interviewed alone) and one couple with children living at home; one couple without children; and one pair of a grandmother and great-grandmother. Four of these interviewees (one couple, one pair of roommates) were cameraphone users. [Note to reviewers: we are continuing these interviews and will update the final paper, if accepted, to incorporate later interviews.]

Interviews were conducted in the participants' homes, and lasted about two hours. We asked them to show us their cameras and their 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.

A subset of these interviews was specific to cameraphone users. Our goal in the cameraphone interviews was to interview dyads, at least one of which was a camera phone user. We were interested in what sorts of photos people take with cameraphones and how they share them. At this point, we have interviewed two such pairs. Our focus groups with graduate students were also all recent cameraphones users. Our findings support those of [30] that people tend to take different kinds of pictures with cameraphones: random things to make friends laugh, things they find interesting or beautiful, and photos of friends

We asked questions all participants about the following:

(1) Their camera equipment and photography habits: what kind of camera they own and how they decided to purchase it, what they do and don't like about their camera, and, finally, to get at possible future uses we asked, "If we had magic technology that could do anything you wanted, what do you wish your camera could do that it doesn't now?" [21].

(2) Their phototaking patterns: when and under what conditions they take photos, of what, how often. We asked whether the photographer gets to be in the photos, and what makes some photos special.

(3) Their photo storage and retrieval, including which photos they keep and why, how long, where, how organized and labeled, and how they find older photos. We asked them what would make this process easier.

(4) Their photo sharing, including under what circumstances and how they show or send photos to others, what kind of photos, with whom, why, how, and whether and how they annotated or captioned photos. We asked the same about the photos others share with them. And again, we asked what they would like to be able to do differently, what would make photo sharing easier.

4.4 Findings

In this section we report *what* people did: what photos they took, and what they did with them. In the following section we discuss the *social uses* of personal photos.

4.4.1 Cameras

Most of our participants owned or had access to a digital camera. While some were avid digital users, others were still getting acquainted with digital photography. Most had multiple cameras, often both analog and digital. Those who actively used multiple cameras tended to have particular uses or reasons for each. For example, one person found the shutter lag on her digital camera too slow for candid shots of children, so she used both a digital camera and an analog point-and-shoot camera. Several people used analog cameras because they had interchangeable (especially zoom) lenses. Most of the digital cameras were smaller and lighter than analog cameras and so people tended to carry digital cameras around more, reserving analog cameras for photo expeditions. Most participants believed that analog cameras created better quality images (though few had tested this for themselves). Participants who carried both analog and digital cameras reported capturing more "important" images on the analog cameras (i.e., pictures they think they will cherish for a long time).

4.4.2 Phototaking Patterns

Our findings about the kinds of pictures that people take are con-

sistent with those of earlier research. Among our participants, pictures tended to be of family and friends, vacations, and special events. Pets were also popular. We identified two other distinctive types of photos: "art" (taken for aesthetic reasons) and "fun" (funny in and of themselves, or in the context in which they were to be used). For example, one participant takes daily pictures containing a gnome that a friend posts on the web (See Figure 1).

Figure 1. "Gnome at Grand Canyon" from gnomar.com

Participants who had taken other kinds of photos earlier, but then had children come into their lives, reported a sharp drop in non-family photos [10]

Both print and digital photos were subject to what we called a "funnel effect" in which many photos taken, while only a few get added to albums. Ratios varied from 10-to-1 to one participant displaying all but a few "indescribable" photos. Most commonly, between 10% and 25% of photos taken were put on display in photo albums, frames, bulletin boards, refrigerators, and the like.

Our preliminary review of photos online, including photoblogs, showed that people use online sites for many of the same purposes (friends and family, vacations, events), but with a preponderance of fun or art pictures which are more likely to be meaningful to strangers on public photo sites.

4.4.3 Storage and Retrieval

Consistent with other studies [16], we found that time is a major organizing principle for most photo users, both digital and analog. Photos taken over time are automatically ordered by both technologies: all prints from a roll of film come back from developing sequenced in an envelope; the photos downloaded from a camera to a computer are given sequential identifiers based on when the photos were taken or downloaded. Many users reported being "too lazy" to annotate and impose their own organization on photos. And, for the most part, time is a useful organizing principle. Photos taken at or near the same time are often of the same content. A favored few images get added organization by person, place, or event. Most digital camera users had no more than one layer of folders, with folders given a descriptive name about place, event, or person: e.g., "Mexico," "vacation," "family."

4.4.3.1 Archiving

Everyone who had prints had what we came to refer to as "the box," often multiple boxes, drawers, and sometimes bags: the place(s) where most prints ended up, not in albums but in the envelopes from which they came back from processing. While participants differed in their propensity to throw away photos—which seemed to correlate with their overall habits of collecting versus discarding—many found it much harder to throw away prints than to delete digital images. Some talked about preserving the integrity of a "roll" as a record of an event, throwing away only the greatest failures. Many surprisingly saw prints as more appropriate than digital media for archiving images. Some spoke of computer failures and losing image files. (Although one reported having her house burn down with all her prints and another participant lost a prized envelope of selected photos of her family on an international flight.) Since some had old family photos that had been handed down in paper form (none reported having old negatives), their sense of paper as an appropriate archival medium is based in part on experience. Some of the digital users worried about the obsolescence of digital storage media. Some of the digital users stored digital images on CDs, not on their hard drives.

4.4.3.2 Annotation and Metadata

Most participants reported minimal annotation, most commonly a scribble on the outside of an envelope of prints noting date, location, or event, and maybe people: e.g., "Yosemite, Summer 2002, with Jeff." Digital photos are sometimes given descriptive names if and when users edit and save a photo: e.g., "girls&santa.jpg." A few participants—working with paper prints—do extensive annotation about the photo and its circumstances, in essence telling a story about the photo, in the margins of photo albums or on the pages of a scrapbook.

Most participants tended to rely on their own memories concerning the content of photos. They generally wanted the photos dated and appreciated prints with the dates on the back, while they universally hated digital images with dates embedded in the image. They were less concerned with recording other metadata, generally saying that they knew the people and places. This reliance on memory instead of metadata had several possible reasons. First, participants complained about the time and effort required to annotate photos (and organize them in albums or folders). Second, as we discuss below, the act of face-to-face oral storytelling with photos was important. We asked people if they would like a way to record audio clips with pictures—annotations and stories, similar to the current "talking frames." Reactions were mixed. In essence, people did not want to do the recording. But another reason that seemed to be more potent was the preference for face-to-face storytelling outweighed any perceived benefits of recorded audio.

4.4.4 Sharing Photos

When we asked with whom they shared photos, the answer was, understandably enough, mostly family and friends. When we asked which photos they shared, the prevailing answer was images of people or events of significance to the recipient. One person said that the grandparents wanted photos of the grandchildren, not of the family's vacation; they were interested in the people, not the place A few participants maintained photoblogs and had the added dimension of sharing photos with "fans" of their blogs who included known and unknown people.

People often shared photos by simply passing around envelopes of prints. Some left prints lying around in high-traffic areas of the house for people to look at as they wished. A recurring artifact in our visits to people's homes was a wall, shelf, or mantlepiece covered with photos of family and friends (See Figure 2). These

photos are always on view, and act as a continual, passive reminder of persons and events.

Figure 2. Home Display of Family Photos

Some participants used digital cameras or cameraphones to transport, display, and share digital images. Sometimes they simply looked at images on the camera, in other cases, they plugged the camera into the TV. Most participants were not opposed to viewing images on computers, and some even commented on the quality of the image (larger and crisper than a print). Some did view images on their computer with family and friends. Those whose images were mainly digital used the computer for their own viewing and others'. But the sociality of viewing images together seemed to be associated in most participants' experience with the act of viewing prints, especially in photo albums.

Some talked about emailing photos, especially to distant family, and some used or wanted to use photo sharing websites. Many received images as attachments or URLs. People were much more inclined to delete email attachments than to throw away photos received in the mail. Several said that when they share photos they prefer giving (and receiving) photos hand-to-hand rather than mailing them. One person wanted to be able to "squirt" photos from her PDA to another's using infrared, because she spoke of the other as being in the same room, not distant. Particularly good photos may be framed as gifts. Photos, ranging from loose snapshots to framed portraits, have a clear connotation of gift [25].

Figure 3. Photo Sharing with a Photo Album

The most striking finding was the connection between prints and sharing. Everyone we talked with had images displayed around the house—the mantlepiece or shelf of family photos (See Figure 2), or the accretion of pictures on the refrigerator. Photo albums have a particular place in photo sharing. The act of looking at (and, more rarely, making) an album is a social act, two or three people sitting together to look at the pictures and tell stories (See Figure 3). While many albums are chronological, some represent special events (vacations, anniversaries) and some are of people—one respondent is making an album for each of the children in her life, with photos showing them over time. Interestingly, while all participants enjoyed sharing prints with other outside of the home, people didn't take their photo albums to other people's houses, but would show them to visitors.

4.4.5 What features do they want?

When we asked people what features they would want on a camera, the most commonly named was zoom. Many didn't explain why—we gathered three major reasons. First, zoom gives people more control over the image itself, the ability to, in essence, crop an image in the camera. Second, zoom gives some control over place or location: the photographer can move closer without moving, for example, when taking a picture across water. Third, zoom allows a difference between social and physical space. One person commented on wanting to take a picture of someone sitting at a sidewalk café in a gorilla suit, but was reluctant to pull out her zoomless camera so close to the subject. Interestingly, most current cameraphones (which lack zoom and have fairly wide angle lenses) require that their users enter a subject's intimate space of physical proximity (2 feet away or less [18]) in order to get a close-up shot of a person's face. Another highly valued feature was flash, which gave people more independence from lighting constraints and enabled night photography. Digital camera users often wished for better resolution—most had moderately-priced cameras with similarly moderate resolution. Several people wanted a digital camera for children: inexpensive and rugged. Several told us that their children did take pictures, even fairly young children. Digital cameras would provide the instant gratification of seeing their image, and avoid the cost of printing.

5. DISCUSSION

5.1 The Social Uses of Personal Photos

Our findings provide a catalog of what our participants said and demonstrated about their personal photography practices. Underlying these various actions are social uses that these actions satisfy. We identified a set of social uses which seem to motivate and shape the imaging practices we observed and documented: memory (both personal and collective), relationships (both creating and maintaining), and self-expression. These social uses interact with material aspects of the imaging technology, embodied social communication, and narrative activity employed by our participants. Specifically, these uses help to explain the high value placed on the materiality of photographic artifacts, the surprising centrality of unmediated oral communication in our subjects' use of photos, and the recurrent use of photos in storytelling, which calls upon and serves all of these factors: memory, relationships, self expression, materiality, and orality.

5.1.1 Memory

A major theme in the interviews was the role of photographs in memory, personal and collective. Images have an ability to evoke

memories, including sensual memories. One respondent who is now seriously ill spoke of viewing pictures from earlier parts of her life, especially travel, and remembering not just the sights but the tastes and smells of other places. An active photoblogger realized, after a year of photoblogging, that she had a record of her life during that period for herself and her as-yet unborn children.

Photos are not only about one's own memories but others'. Our ill participant is preparing albums for each of the children in her life consisting of photos and written stories about times she spent with them. She says that this is not only so that they will remember her, but to help them see what they themselves were like. We conjecture that people's attitudes toward photo annotation are associated with issues of memory and mortality. The person described above spoke frankly about wanting the children to remember that she had been a part of their lives. On the other hand, 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.

The memory function of photo use has informational components, but is strongly emotional. Favored images were usually spoken of not in terms of the quality of the image but of the memories and emotions evoked. In this context, "the box" has a particular benefit: rummaging through a box of photos creates unexpected encounters with images and thus with memories, an unplanned, undirected revisiting of events, people, and emotions. A couple looking through their images with us exclaimed with pleasure when the found an image of an event they had forgotten.

5.1.2 Relationships

The strong presence of family and friends in people's photos highlights the importance of interpersonal relationships and photos. Photos are used, not just to remember people and events, but to maintain existing relationships and even create new ones. Photos were valuable not only for themselves but for the connections among them and among the people represented, and for the active role they played in relationships.

People were often identified (by themselves or others) as the family/group photographer or the family archivist. These people tended to see the task of maintaining the photographic record as critically important, especially within families. One interesting issue is how the photos of earlier generations migrate forward. The informal family archivists keep track of who has which old family photos and try to acquire and consolidate the collection. A student whose family is now spread across at least two continents brought back old family pictures from a recent trip to his family's homeland and is now trying to identify the subjects and their family relationships. He is scanning the images to create CDs for family members. These photos were not simply informative, but were material traces of the continuity of the family over time and place. Other participants are the photographers for a family or social group who count on them to take pictures. Unfortunately, the photographer is rarely in the picture: the person who cares the most about documenting events and keeping track of friends and family is often the least visible.

Many people spoke of sharing photos to keep people up on what's going on in one's life, as a form of reporting or journaling, but also as a way of connecting to loved ones. We spoke with a couple who had spent a year living on separate continents, during which they used photoblogging extensively and would send photos to their private photoblog in near real-time "like a kiss or a hug." Cameraphone users talked of sending photos sporadically throughout the day just to make the other laugh. The sense of real time capture and sharing (i.e., the "Power of Now" we identified in our focus group studies [40]) was important to the senders. One way that online images help maintain relationships is when a viewer finds that a photographer has posted an image of the viewer—an indication that one is important to the other. A young person's photoblog had a section labeled "friends" with the notation, "If you're here you know you're loved."

While traditional photo sharing served largely to maintain existing relationships, the photobloggers also used their blogs to create new social relationships. One person discovered that her blog helped her to make connections in a city where she knew few people: her blog had readers, some of whom she connected with via the blog, some of whom she met, including one who recognized from her images that they lived in the same neighborhood. Photos—especially photoblogs—are also a form of self-presentation [15], which is about managing others' impressions of oneself. Like personal webpages [27], photoblogs are a way of creating an online identity. Photobloggers did not want to incorporate other people's photos in their blogs since their blogs were about "their own point of view on the world."

5.1.3 Self-Expression

Photos are also used as self-expression, including art and fun images. Although self-presentation and self-expression are related, self-presentation is about influencing others' views of oneself (which may include deception), while self-expression is about giving expression to our "authentic" self. Several participants clearly distinguished their picturetaking that was for recording family events from their photos for self-expression. Two of our participants worked in black and white at least part of the time for their art photography, and color for other photography. One notable finding from our review of online personal photos was how many seemed to be intended to be artistic or beautiful images.

5.2 Media and Resistance

Understanding image-related activity helps to explain two surprising findings from our empirical work: participants' attachment to printed images, and their resistance to recording metadata. 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.

5.2.1 Materiality

A major theme in our interviews was the ways in which people used the affordances of the materiality of printed images. Many participants relied heavily on prints, even of digital images. The exception seemed to be users who had access to web-based tools for sharing photos, or photoblogs, who printed less.

The social theoretical approaches to activity and distributed action that we described in Section 3 stress the importance of artifacts and their particularity as shaping behavior and carrying prior understandings and practices. They also stress the interpretive flexibility of technology and how people find ways to align artifacts and practices to accomplish their goals.

The materiality of prints interacts with the social uses of images and the practices of creating, using, and sharing them in striking ways. Displayed and casually scattered prints enabled unplanned

and repeated encounters with images. Participants generally treated prints as more precious and less easily discarded than electronic images. The sharing of prints also had clear connotations of gift. People generally preferred sharing them face to face if possible. Even when the image wasn't of interest, the fact of the gift of a photo was considered to be a significant part of relationship maintenance and an expression of caring and connection.

Participants expressed the greatest sense of obligation and of dereliction around the creation of photo albums. Those who regularly put prints in albums spoke of being "behind," and some could even tell us how far behind they were ("four months;" "those envelopes on the shelf"). People repeatedly used the self-judging word "lazy" to describe their lack of annotation and albuming. People who didn't create albums said that they "ought to" and "definitely planned to." Albums appear to be sociotechnical artifacts for which people feel a responsibility toward others. There are norms of behavior associated with pictures, especially albums, such that people felt a responsibility to be maintaining albums.

5.2.2 Orality

A surprising and significant finding in our study was the central role of face-to-face oral communication in our participants' use of photos, and their overall lack of interest in assigning metadata and making annotations. The act of sharing photos in a photo album was as much (if not more so) about talking with family and friends as it was about looking at the 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 vast majority of contextual and content metadata (i.e., who, what, where, when, why, etc.) of photos was stored in human memory and transmitted through intimate speech.

To better understand the function of oral communication in our participants' use of photos, we refer to the work of Walter Ong [31]. Ong's classic study of orality identified three main phases in the evolution of communication and media: "orality" (or "primary orality") is the phase of oral culture prior to the advent of writing; "literacy" is the phase from the invention of writing through the invention of the printing press up to before the advent of the first electronic communications technology; "secondary orality" is the phase from the invention of the telegraph to the present day and recovers some aspects of orality by connecting people across space through mediated interaction (e.g., the telephone). In the modern day, aspects of primary orality, literacy and secondary orality all intertwine in our social uses of communication and communications technologies.

According to Ong, orality has seven main aspects, six of which speak directly to our findings as to how and why people talked about their photos to one another: orality is (1) "evanescent" (i.e., it produces sounds which have no record); (2) "additive rather than subordinative, aggregative rather than analytic" (i.e., it has different organizing principles than written communication); (3) "close to the human lifeworld," rather than about abstract concepts); (4) "agonistically toned" (this aspect of orality was absent from the intimate social structures we studied); (5) "empathetic and participatory rather than objectively distanced" (6) socially cohesive and knits people together into community; and (7) "homeostatic" (oral cultures change slowly and yet are continually renewed in each generation).

The centrality of orality in our subjects' use of photos appears in interesting contradistinction to the emphasis on the materiality of prints. The combination of orality and materiality makes sense in terms of the social theoretic emphasis on objects as organizing activity. The photo needed to be an object; the photo's detailed metadata existed (with few exceptions) primarily as interpersonal and intergenerational conversations that were evanescent, additive and aggregative, close to the human lifeworld, empathetic and participatory rather than objectively distanced, functioned to bring about social cohesion and community maintenance, and aspired to homeostasis by trying to both renew and preserve the memories and experiences of individuals and groups. 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. This resistance presents an intriguing and important challenge to digital imaging application designers.

Seeing our participants' social uses of photos as an admixture of orality and literacy, we can understand the process of photo albuming within the context of a similar practice born in early oral culture, that of the rhetorical memory palace. Frances Yates describes the memory palace of classical rhetoric [41], a cognitive device used in oral culture to remember and deliver long speeches. The rhetor would visualize a familiar architectural structure like a palace and to remember parts of a speech would imagine a series of highly evocative images placed in the alcoves of the palace. To deliver a speech the rhetor would in the mind's eye stroll through the memory palace stopping at alcoves to unpack the discourse that had been condensed in the highly evocative, often allegorical images.

In the oral process of storytelling with photos we see striking similarities to the rhetorical memory palace: images and image sequences that are evocative and condensed, i.e., that can elicit narrative discourse, are selected for inclusion in the photo album and the arrangement of images in the album is designed to facilitate the oral production of a narrative. It is in the narrative function of photos and photo sharing that we see all of the preceding social uses of memory, relationships, self-expression, materiality, and orality come together.

5.2.3 Storytelling

Personal photos are used as an occasion for storytelling: "this is when we went here and did this and so-and-so was with us." Stories are for both the people who were there ("remember when we…") and those who weren't ("this is your Aunt Mary who…"). Personal photos support the oral transmission of family stories and intergenerational experience and knowledge. Storytelling is a recurring use of photos deeply connected to the social use of memory as well as a fundamental cognitive process for organizing and remembering experience. As Endel Tulving points out, "episodic" memory is a fundamental way we remember events in our own and other's lives [36]. Jerome Bruner describes narrative as a basic mode of cognition that enables us to organize our experience as narrative events in order to be able to better understand and remember them [9]. "Narrative Intelligence" researchers see narrative as a fundamental form of human intelligence which many seek to represent, manage, and produce computationally [3]. The narrative use of photos among our participants serves to

structure and transmit personal, interpersonal, and especially intergenerational memory, to replay, share, and deepen social experience and relationship, to express personal and group identity, relies on the materiality of the photographic artifact as a condensation and elicitor of story, and functions through, and enables to function, intimate oral discourse.

5.3 Conclusions

Social theoretical perspectives, especially the SCOT approach, caution us to ask what culturally and historically conditioned motives, intentions, and practices—in our terminology, social uses—shape both the content and the form of people's actions. Artifacts (like photos) carry a prior history of practice and understandings and shape people's actions. Photos—specifically prints—are deeply implicated in memory, relationships, and self-expression. The tangible photo and associated material artifacts like photo albums are almost inextricably part of the practices of orality and storytelling. Digital images can of course be printed. Beyond that, digital images also support new practices aimed at prior and emerging social uses, as shown by the popularity of the photoblog—a technology situated within the social uses of memory, creating and maintaining relationships, and self-expression.

Our point is not to be pessimistic about digital imaging—which is overtaking film—nor to insist that digital technology will simply replace film as a capture medium for producing printed photos. Rather, our point is that examining the social uses and associated long-established practices, the deep, mutual constitution of social uses, practices, technology, and artifacts, we get a much more complex, complete, and nuanced understanding of the domain for which we are designing, which can only improve our designs (while nonetheless complicating our task).

6. IMPLICATIONS

This study aims to provide a new approach to the design of digital imaging, especially cameraphone, technology by arguing for the investigation of the social uses of personal photography as a foundation for design. By uncovering the underlying social uses that digital imaging technologies can address, we can design technologies that people actually want and use.

This paper is intended to demonstrate the value of this approach for anticipating future uses and users of a new technology. Science and technology studies (STS) and the SCOT approach generally deal with explaining technology success after the fact as an interaction of technology and the social, with an emphasis on the problems, goals, and activities of potential technology users. This paper demonstrates that the analysis can also go the opposite direction, asking whether and how an emerging technology may be aligned with pre-existing activities, goals, and needs. It also demonstrates the value of social science approaches concerned with understanding human action, not just in relation to technology.

More specifically, this paper shows that *social uses* are an essential construct for user-centered inquiry. To design technology to be useful and used, we need to understand not only *what* users are doing but also *why*. Like Activity Theory, our approach employs a level of abstraction above the specifics of actions to understand the larger situated goals and intentions behind them. We also need to understand how artifacts of all kinds carry history and culture, and shape as well as reflect understanding and action. We cannot understand how users will respond to new or redesigned artifacts without understanding the meaning that they have for the users.

Several implications seem clear: 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.

We do not yet have answers about what to design in light of these findings, but argue that they are significant in their influence on the resistances and affordances of current and future digital imaging technology. Moreover, if we can serve multiple social uses of multiple social groups simultaneously, we can design technologies that may achieve easier and more widespread adoption.

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 [11, 35, 40]) 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.

6.1 Future Work

The social uses of personal photography outlined in our study lead us to think about new ways to design digital imaging applications. We plan further interviews with photo users, particularly more discussions with current cameraphone users. We will address a more diverse group, including more non-family photo users. We will also continue our examination of public photo sites. We intend to ground our future technological design process in the continued study of social uses. We will use our studies of social uses to inform our design methods and technology development of our next-generation Mobile Media Metadata prototypes and use our technology prototyping to help us uncover and better understand the underlying social uses for imaging technology. Finally, we will continue work on the theoretical framework, investigating the uses of social theoretical work, especially from STS, for the design of technology.

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