

The Social Life of Cameraphone Images

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ABSTRACT

Cameraphones show the potential to revolutionize personal photography. We gave cameraphones linked to an Internet-based uploading and sharing system (MMM2) to a tightly-connected group of 40 people for up to ten months. This paper examines cameraphone use as both continuous and discontinuous with prior practices in personal photography. We describe the social uses of cameraphones we observed among our participants: creating and maintaining social relationships, constructing personal and group memory, self-presentation, and self-expression. We note that the success of new technologies depends in part on how well they integrate with the users' heterogeneous networks of technologies, practices, and people.

Author Keywords

Cameraphones; photography; social uses of photography; activity theory; SCOT

ACM Classification Keywords

H.5.2 User Interfaces: User-centered design; H.5.2 User Interfaces: Human factors.

INTRODUCTION

Personal photography is pervasive practice that engages us all as photographers, subjects, and/or viewers. Recent developments in digital imaging and Internet-based image sharing are changing photographic practices in major ways. We contend that cameraphones, especially in combination with the Internet, have the potential to revolutionize image production and sharing. However, reports are mixed [1, 24] about the extent to which people are using cameraphones to send images, especially in the US.

The larger question that interests us is fundamental in

design of new technology: we want to understand the varied ways in which people adopt, adapt, appropriate, and redesign-in-use new technology. This study of cameraphones is a kind of case study in technology adoption.

In this paper, we report on a 10-month-long study in which we gave cameraphones and an Internet-linked uploading and sharing application to 70 people, 40 of them members of a tightly-linked social and professional network. Other cameraphones studies [18, 21, 25] have followed smaller numbers over a shorter time. This study was long enough, with enough users, connected to one another, to see use stabilize, and a variety of kinds of uses emerge.

We developed a method of interviewing, based on photo elicitation, a method developed in anthropology, that used visualizations to root our interviews in participants' actual images and image-making and sharing practices.

In an earlier study of photographers using film and digital cameras [34] and a review of the literature on personal photography, we identified four social uses of personal photographs: creating and maintaining relationships; constructing personal and group memory; self-representation; and self-expression. Here we found that cameraphones recapitulated but also extended these social uses and changed the balance among them.

ANALYTICAL FRAMEWORK

Our approach to understanding the uses and meanings of cameraphones and cameraphone images is rooted in constructivist approaches to technology including Social Construction of Technology (SCOT) [5] and Activity Theory (AT) [10]. We borrow from AT its emphasis on the user's goals or motives, which AT calls *activities*. AT posits a hierarchical relationship among activities, actions, and operations. A single higher-order activity may be supported by a changing array of actions and operations. People may choose among alternative actions for the same purposes or have alternative purposes for the same actions. AT also emphasizes community and the cultural setting as factors shaping activities, actions, and operations. Finally, artifacts play a mediating role, both carrying and shaping understandings and actions.

A key concept that we borrow from SCOT is *interpretive flexibility*: a given artifact may have multiple meanings for the same or different users under different circumstances.

These meanings are influenced but not determined by the design; they are created by users as they match the possibilities of the technology to their ongoing experience and activities.

Another key concept that we borrow from SCOT and related social constructivist approaches to technology [23] is *heterogeneous networks*: heterogeneous assemblages of people, technologies, practices, understandings, and so forth. Formal and informal, emergent design are seen as processes of *heterogeneous engineering*, integrating these varied bits and pieces. No technology operates on its own, to understand adoption and use of a technology we have to understand it as it is (or is not) as part of such a network.

Our analytical approach is rooted in grounded theory [8, 12] which begins not with theories and categories but empirical evidence. Grounded theory draws on all kinds of evidence: interviews and observations, documentary evidence, and the researchers' own knowledge (since there is no "view from nowhere," researchers' experience is no more nor less valid than anyone else's). The purpose is to iteratively generate conceptual categories, properties of categories, and relationships among them, from evidence. It is a process of continual comparison, searching within the data for new insights, and seeking out new data to expand or refute the emerging theory.

RELATED RESEARCH

Personal photography has been the subject of research in many fields. Sociology, anthropology, and, more recently, the interdisciplinary field of visual studies have long been interested in personal photography (e.g., [4, 6, 7, 27, 30]).

However, this literature has been surprisingly slow in addressing digital photography, which has been left largely to HCI [3, 11, 17, 20] where much of the research has been aimed at understanding the uses, organization, and retrieval of images to support the design of systems to support these activities.

More recent research addresses cameraphones. Researchers have studied cameraphone use in Japan and Finland, where deployment and use have preceded that in the US, and in the United Kingdom and the United States. Okabe and Ito [25] interviewed and conducted diary studies with 15 participants in Japan over two months in 2003. The pictures their participants took fell into three categories along a continuum of sociality: records of daily life for personal use and short-term recollection, photos sent to "intimates" to maintain virtual co-presence, and photos of personally newsworthy events shared with friends from the handset or occasionally sent via email or MMS.

Koskinen [21], in an early investigation of MMS in Finland, supplied four groups of five people with "constructed" cameraphones consisting of a digital camera and a Nokia Communicator and asked them to email shared photos to him over a 2 to 3 month period. Participants in one group of five sent over 2000 unique images. He found

that senders used captions to capture and direct the attention of the recipient(s), and recipients often replied with elaboration or clarification requests, sometimes accompanied by photos. He also noted some cases of pictorial riddles and other playful exchanges.

Kindberg et al. [18, 19] conducted interviews and performed two to five-week diary studies with 34 cameraphone users in the UK and US. They described cameraphone image use as occurring along three axes: "functional" to "affective," "social" to "individual," and "now" versus "later."

Voida and Mynatt [35] report on a study of a system called Lascaux that embedded webcam images in instant messages (IMs). While the study is not about cameraphones, their participants were engaged in what they called "the communicative appropriation of images," similar to much cameraphone use. The researchers tracked eight self-selected participants and 14 additional image recipients over four months. They logged 202 IM sessions, of which 120 used a total of 806 images. They found six kinds of communication: amplification of the communicative intent of a message, narrative (using sequence of images to tell a story), awareness (indicating presence and activity), local expression, and invitation to greater sociality.

However, we have to be careful in generalizing across these international studies. Ito [16] describes how the Japanese mobile phone practices, such as mobile email during long commutes on crowded trains, specifically suit Japanese living conditions. Similarly, text messaging suits young people's lives across several cultures, where silent messaging allows continual connection to friends. She exhorts researchers to consider social, cultural, and historical specificities in generalizing across studies.

STUDY OVERVIEW

Seventy people were provided with Nokia 7610 cameraphones equipped with the MMM2 sharing application and with free service, including unlimited data transfer.¹ The cameras on the 7610s were one mega-pixel, with night mode, video, and digital zoom. The cameraphones were distributed in November, 2004. Most participants had phones and service until March, 2005, but some had service until August, 2005.

In earlier interviews with US cameraphone owners [34], we found barriers to cameraphone use included poor image quality, difficulty "getting the images off the phone," no one to share images with, and cost, including high cost or uncertainty about the cost to senders and recipients. Our study removed these barriers by providing free service, automatic uploading, and easy sharing among a closely-connected group – a case study for what use will be when cameraphone imaging and sharing are easy and cheap.

MMM2: Integrating Cameraphone and Internet

The cameraphones were pre-loaded with the second generation of the Mobile Media Metadata photo-sharing system (nicknamed MMM2) built by Marc Davis and his

associates [9]. MMM2 automatically uploaded all pictures and videos² to the user's own web-based MMM2 space, from which photos could be annotated, organized into albums, shared with anyone with an email address in the MMM2 database, and deleted. (Though participants deleted very few photos, we must assume that photos that participants considered sensitive are under-represented in the data.) MMM2 integrated cameraphones with the Internet, allowing users to switch between them in ways that articulate with their personal "sociotechnical ecologies" [16]. MMM2 also allowed users to add captions from the phone, and to send notices of image sharing (not the images themselves) from the phone to MMM2 and to non-MMM2 recipients.

MMM2 images could be downloaded from the MMM2 web and treated like any other digital images. In addition, each MMM2 image had its own URL, and participants reported emailing the URLs and embedding them in instant messages. MMM2 allows users to navigate between the convenience and ubiquity of an ever-present imaging device and the ease of viewing, selecting, sharing, and receiving images via a desktop machine and the Internet.

Participants

The larger group of 70 registered MMM2 users included 40 first-year graduate students in the UC Berkeley School of Information Management and Systems (SIMS; since renamed the School of Information) and several faculty. The graduate students are largely re-entry students whose average age is 29; 62% are female. The department's curriculum includes technical subjects, the social sciences, and policy and organizational issues. Students come from a variety of technical and non-technical backgrounds. The students work together closely and also socialize. Their intensive academic work, which includes much collaboration and group projects, and the monopolization of their time by their studies means that social and professional ties within the group are strong, as was confirmed in our interviews.

The researchers were participant observers, with Nokia 7610s and MMM2 accounts of our own. We took photos and shared them with people in and outside MMM2. The rest of the MMM2 users were miscellaneous individuals affiliated with SIMS or with the development group.

We classified 42 of our 70 users, or 60%, as "regular" users. To eliminate those who experimented briefly with the cameraphone and then abandoned it, we defined "regular" users as those who met two out of these three criteria: they captured at least 13 images; 30 days or more elapsed between their first and last images; and/or they averaged at least 0.33 images per day. This was a smaller proportion of total users than might otherwise have been the case because many continued to use their own mobile phones (in order to not change their numbers) and many didn't want to carry the Nokia 7610 as well.

This figure does not show the *enthusiasm* with which some participants reported incorporating cameraphone imaging into their lives. Some averaged over 8 images a day. Many described cameraphones as transforming their daily practices to include more images and in more ways than ever before.

DATA COLLECTION

Sample Images

We analyzed a random sample of 400 MMM2 images. Personal photos have both private and public meanings. The public meaning is what a stranger sees in an image, while the private meaning depends on its personal significance. The same image, may take on different meanings depending on its context of use. Below we will discuss the public meaning of this sample of image.

Interviews

We interviewed 26 MMM2 users, all drawn from the student participants because we wanted individuals connected with other MMM2 users. Most were moderate to heavy MMM2 users, but we interviewed two light users for contrast. Participants were interviewed up to three times: near the middle of the project, near the end, and after the end of the project (based on their availability). We asked about their photographic history and practice in general, and with cameraphones and MMM2. The post-study interviews asked about their post-MMM2 photographic practices, including whether they were using a cameraphone and how they thought MMM2 had affected their interaction with their fellow students and their

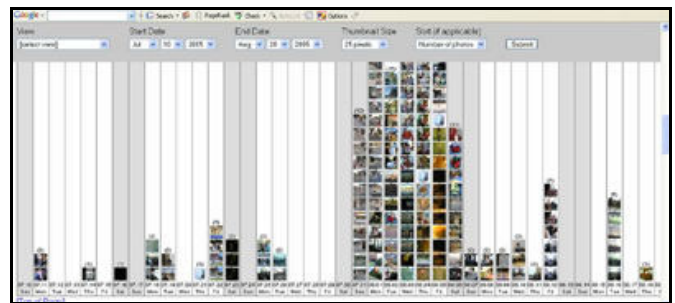


Figure 1. Photo-chronology visualization.



Figure 2. Photo-sharing visualization.

subsequent photographic practices.

Interviews lasted one to two hours. One researcher interviewed, a second took notes, and a third operated a video camera. Interviews were then transcribed.

Photo Elicitation

Interviews, as retrospective accounts, are often limited by participants’ memories and perceptions, which are not always accurate. Photo elicitation is a method developed in anthropology [14]. The interviewer shows photos to participants to elicit some kind of response. In reflexive photo elicitation, the participants themselves generate the photos upon which they comment. They may be asked to take pictures of certain themes or of events and objects in their lives.

MMM2 automatically collected participants’ images and tracked their MMM2-based sharing, so we could examine these traces of their photographic actions. With their permission, we accessed a complete set of each interviewee’s images. Two MMM2 developers created a visualization, described by Van House [32] that sorted thumbnail images by capture date (Figure 1). Thumbnails were small to protect the privacy of both the photographer and the subjects, but clicking on one opened a full-size view. Participants could generally identify the images without interviewers being able to distinguish their content.

Male	11
Female	15
Total	26
Used MMM2 & Flickr	6
Interviewed once	17
Interviewed twice	7
Interviewed three times	2

A second visualization (Figure 2) displayed the shared images organized by recipient, and the images the participant has received from others. (Sharing outside of the MMM2 system, such as via regular email, could not be recorded.) Participants were able to see who their most frequent sharing partners were, and to distinguish sets of images that were shared repeatedly, and with whom.

The images jogged participants’ memories about the pictures they had taken, the subjects and circumstances, and their sharing. We could ask about specific images: content, reasons for capture, sharing, and so forth, a form of critical incident technique. The images and their related data (such as sharing history) sometimes added to or contradicted the owners’ memories, which validated photo elicitation as an improvement over simple interviewing.

RESULTS

Analysis of Images

The 400 images were categorized according to their apparent subject (where the subject was featured prominently in the pictures, and usually took up most of the picture area), where the pictures were taken, and whether they were captioned. Forty-nine percent were of people. Of those, 52% contained one person, while 22% contained 3 or more people. Only 7.7% of images of people were of children. (Our personal knowledge is that few of the MMM2 participants were parents.) Of the images of people, 49% featured other members of the students’ department, and 5.1% were self-portraits.

The most common nonhuman subjects were text (15%) and technology (14%). Twenty percent were taken in the department’s building or elsewhere on campus. Twenty-one percent were captioned, 39% with descriptive captions (reiterating what is in the picture), 41% with informative captions (giving context), and the rest with unintelligible captions.

While we have no baseline data on other kinds of photography with which to compare these results, we can make some observations. First, these data confirm the findings of our qualitative research that participants were using the cameraphones in their lives more generally and not just on campus to take pictures of their fellow-students, as a sort of shared game or toy.

Second, we observed what we considered to be an unusual number of self-portraits. People reported that the light-heartedness of cameraphones made self-portraits – what we called “arms-length” photos, with the cameraphone held out at arms’ length looking back – acceptable, and often useful for, they said, showing that they were “there.”

Third, this confirms participants’ reports that they sometimes used cameraphones like photocopiers to record text, a functional use more or less unique to cameraphones.

Patterns of Use: Slow and Steady, with Spikes

As of September 21, 2005, 70 participants had contributed 24,412 images to the database, an average of 76 images per day for all users combined. This excludes a small number of images deleted by the photographer, and includes a small number of non-cameraphone images manually uploaded to MMM2 for sharing.

Using the visualization tool, as well as from participants’ self-reports, we found that most regular MMM2 users showed two patterns of image-making overlaid. Most personal photography is intermittent, requiring the planned presence of a camera. We found this pattern with cameraphones too, where special occasions resulted in spikes of picture-taking. In addition, because cameraphones are always present, they promote regular, low-level use, frequent capture of one or a few pictures a day. (The distribution shown in Figure 1 is typical.) Some participants told us that this radically changed their habits as image-

making (and using, including sharing) became a part of their daily lives.

Sharing

A major use of personal photos of all kinds is sharing, and the MMM2 system was designed to facilitate this. Overall, 22% of the images were shared via the MMM2 system. This figure understates sharing in two ways. First, participants would take redundant images to have a good one to share. Second and more important, in the interviews we discovered that not all cameraphone images were shared using the MMM2 system.

Sharing was carefully calibrated with the nature of the relationship and the content of the image. Images were often shared with people who were in the picture or present at an event pictured or “should have been,” such as members of a group who missed an event. Another basis for sharing was the photographer’s view of which images a recipient would find funny or interesting.

From the interviews we learned that sharing usually took place quickly, often within 24 hours of image capture; after that, it was generally forgotten. Furthermore, many images had a short useful life. This highlights an important characteristic of cameraphone images: although some had enduring value, many were highly transitory, with little expectation of future value. Some later proved to have an unexpectedly enduring value, such as a picture that took on added importance due to subsequent events.

Participants’ method of sharing with non-MMM2 users and some MMM2 users was usually consistent with established communication practices and with the perceived capabilities and preferences of the recipient(s). For instance, images would be attached to email to people who were perceived to be not web-literate enough to know what to do with a URL, and image URLs were embedded in on-going IM conversations.

Others [18]) have reported considerable in-person sharing on the phone and sending images from the phone. In MMM2, however, there was some confusion about the location of saved of images and many users didn’t know how to share images with co-present others on the phone. Only 6.7% of images were sent directly from the phone (or 30% of shares), even though the service was free. In the interviews we learned three reasons for this. First, sharing from the phone was slow and sharing with non-MMM2 users was difficult. Second, MMM2 users could specify whether they would *receive* notice of new images on their phones or via email, allowing them to specify the intrusiveness of messaging. Non-MMM2 users only received email. Not knowing when the image would be received reduced the incentive to share from the phone. (One person shared frequently from the phone to ensure that he wouldn’t forget.) Third, the MMM2 system allowed easy sending from its web interface. Many users preferred to select the best ones to send after seeing the full-sized images.

Image-sharing was loosely reciprocal. Participants said that they did not feel a need to respond to a picture with another one, but once an image was sent, that opened the door to further sharing. Image-sharing often helped to reinforce a relationship by adding a new, often casual or humorous, element of communication. Two people who shared many more images than they received said that they did not expect images in return, but, if there was no indication that a recipient liked receiving their images, they would stop.

Taking for Oneself

Not all cameraphone images were for sharing. Many were for the photographer alone, whether for memory or for aesthetic reasons.

Most discussions of photography focus on the images. One of our participants, however, neither viewed nor shared his images: “the aesthetic experience of taking the picture” was what was important to him. The cameraphone enabled him to capture images whenever the impulse arose.

Sontag [29] talks about photography as encouraging “photographic seeing.” Some interviewees said that having a camera always at hand changed their way of seeing the world: always looking for possible images they engaged with the world around them in a new way.

SOCIAL USES: THE INTERPRETIVE FLEXIBILITY OF CAMERAPHONES

From these observations we conclude that the cameraphone is, in the interpretation of users, at least three different devices: a *memory-capture* device, a *communicative* device, and an *expressive* device.

From our earlier interviews with non-cameraphone photographers and our review of the literature on personal photography, we identified four higher-order, which we are calling *social uses of personal photography* [33, 34] creating and maintaining social relationships; constructing personal and group memory; self-presentation; and self-expression. In keeping with our analytical approach emphasizing interpretive flexibility and higher-order, enduring purposes, we didn’t expect cameraphones to be used in exactly the same ways as other cameras, but we did expect some continuity of use. We also expected to see some emerging uses of cameraphone images that were different from other kinds of photos, as people find ways to fulfill their intentions in new ways with new technology.

Memory: the Mundane Comes to the Fore

Popular discourse speaks of photos as preserving memories. It may be more accurate to say that we use them to *construct* memories. Photos are frequently coupled with storytelling – sometimes a sequence of images tells us a story, sometimes a single image acts as the stimulus for a story. These narratives play a key role in constructing both individual and collective identity {Bruner, 1991 4211 /id; [omitted for blind review]} Cameraphones are present for unexpected memorable moments, but they also capture ordinary moments.

Life Chronicling

Cameraphones are used for everyday, mundane images {Kindberg, 2005 4298 /id;Okabe, 2005 4429 /id}. Most of our cameraphone users engaged in steady, low-level picture taking – many days with one, two, or three pictures, mostly of the artifacts, experiences, and sights of their daily lives, a form of “personal archiving” [26]. Sometimes this began as experimentation or playfulness but people then realized that they were building a set of images that took on significance when viewed collectively. Others told us that they either had or had wanted to chronicle their daily lives with other cameras, and found cameraphones particularly useful because of their ubiquity.

“It’s like a chronicle of life ... I just like to save pictures and archive points in my life. ... I have a very strong sentimental streak. [The cameraphone] was just a very easy way of saving different points and I could come back and look at them and get a feel for where I was and where I’ve come ... I’ve wanted to do that with a film camera for years.”

Functional Memory

Another use, much more prevalent with cameraphones than with other kinds of cameras, is the taking of functional images for oneself others. As image quality improves, it is increasingly possible to use cameraphones for this purpose, including to capture text. Participants recorded whiteboards at meetings, text they wanted to remember, or items in stores they were considering buying (Figure 3).

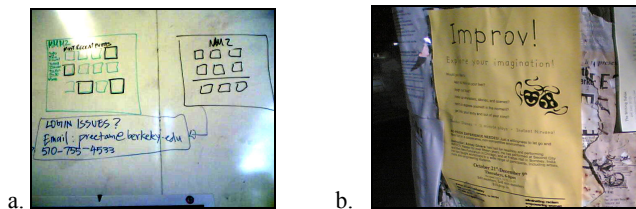


Figure 3. Examples of functional memory images: whiteboard contents, a flyer.

Relationships and Communication

Personal photography both reflects and sustains relationships by who is in the picture and how images are used, especially sharing. Cameraphones are used like other cameras to capture images for relationship creation and maintenance; unlike other kinds of cameras, they are always at hand. They are also used for more immediate communicative purposes.

The Social Group

The ubiquity of cameraphones, we found, resulted many casual pictures of people engaged in daily activities, both work and socializing, what one participant called “Me and my friends hanging out.”

Participants often described “good” pictures as those of people, images in which the participants looked good, and those with emotional content that express the emotions of an event, especially people having a good time.

Cameraphone participants often gave one another pictures in which the recipient looked good.

Many participants reported near the end of their 2-year graduate program that their close relationships with fellow-students were important for their learning. Although the cameraphones were only one part of those relationships, image-taking and sharing was reported by many to have played an important role in building these relationships.



Figure 4. social group images

Once again it is useful to distinguish the content of an image from the act of capture. Sontag [29] notes that the act of taking a picture often labels an event as significant. Among our participants, a practice emerged of labeling social events as important, funny, or otherwise noteworthy by the act of taking pictures. We termed this practice as “signaling.” In these instances, the captured image itself is less important than the playful *act* of image capture itself, which both demonstrates the photographer’s interest in an activity and reinforces social behavior among peers.

Sharing One’s Life Using Images

Life chronicling was not just for oneself. Some respondents kept others informed about the daily nature of their lives via images. One participant shared images on the phone with her husband as part of their usual dinnertime conversation about their days. They both spoke to us about valuing this for its role in maintaining their relationship. More often, people told us about sending images of their daily lives to friends and relatives. One woman sent her distant boyfriend 190 pictures over three months “because I wanted to stay in touch.”

This sharing of images supports what’s been called “experience sharing” [2] or “intimate visual co-presence” [15] – elsewhere [31] we’ve talked about “distant closeness”: the ability to monitor one another’s lives via images (sent, or posted, including on Flickr) without direct interaction.

Interviewees spoke about this not only in terms of sharing their images, but viewing others’. As one said:

“You could spin it in the voyeuristic sense ... it gives me a chance to inhabit you, your body, your eyes, whatever ... that’s fun ... We wonder, ‘What do others see? Am I missing out on something? What do they see, what are they doing, are they having more fun than me?’”

Communicating with Images

An important form of taking-for-sharing was images taken specifically for communication. Kindberg et al. [18] talk about functional versus affective uses of images. We see this as a continuum. Functionally, images can be more efficient and effective than text. The ubiquity of cameraphones makes it easy to capture and send such images. For example, one participant sent a picture of traffic to show the reason of his delay (Figure 5b).

Using images for both functional and affective communication was highly important in this group. Even functional communicative images often had a light-hearted component.

Image-based messages were often telegraphic, highly indexical, and situated, with little meaning for anyone other than the sender and recipient, and with a very short period of viability. For example, when two students were working late separately on an assignment, one sent the other an image of a coffee pot. See also Figures 5(a) and 5(b).

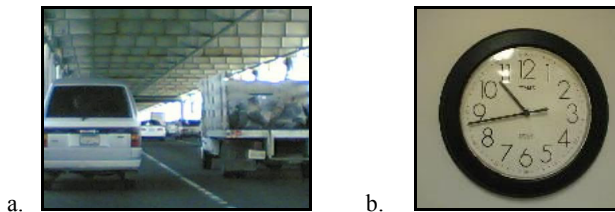


Figure 5. Examples of communicating with images: “In traffic and will be delayed,” “It’s time for fun.”

Self-Presentation and Self-Expression

People engage in many kinds of self-presentation, efforts to influence how others see them [13]. Image creation and especially sharing is often a form of self-presentation. Any kind of image can be used for this purpose – humorous images, for example, are a way of saying, “This is what I find funny,” and artistic images say “Here’s where I see beauty.”

One direct form of photographic self-presentation is the self-portrait, of which we found a surprisingly large incidence (5% of our sample of 400 images) (Figure 6(a)). Cameraphones were often seen as less serious than other cameras, so images that might be considered narcissistic were seen as playful. One participant said that felt comfortable taking and sharing such images because other people do so. Other forms of self-presentation were also common: pictures of one’s pets, meals, belongings, space, and so forth.

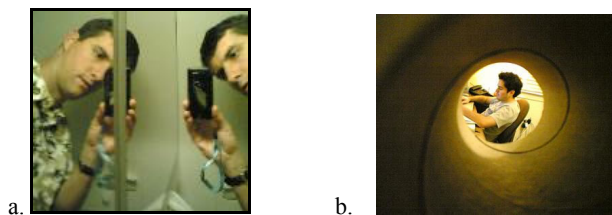


Figure 6. Examples of self-presentation and self-expression: self-portrait in a mirror, friend down a tube.

By self-expression, we mean images that express one’s own view of the world – artistic, funny, experimental, or otherwise expressive (Figure 6(b).) They may or may not be shared. Self-expression is about exploring and expressing one’s unique view of the world.

Self-expression and self-presentation are closely related, since we often seek an audience for our artistic or humorous expression. But whereas self-presentation focuses on influencing others’ view of oneself – which may be manipulated, partial, or in some other way a performance – self-expression may or may not be intended for an audience. Our respondents took many photos of this sort. The ubiquity and perceived playfulness of cameraphones made this kind of picture-taking more likely, allowing people who did not see themselves as “artistic” to experiment with creating aesthetically-pleasing images.

Again, some participants said that the act of photography and not just the image is often important. Self-expression is often more about the act of photography than its product.

ENTER FLICKR

In our post-MMM2 interviews, we learned that many former MMM2 users (the ones that we interviewed and their friends) were now using Flickr.com, a free public image sharing site. Some said that MMM2 showed them the value of online sharing, for which they were now using Flickr. One characteristic of Flickr often cited as superior to MMM2 is its publicness. Whereas MMM2 images were shared with selected recipients at the instigation of the owner, Flickr is publicly-accessible. Images can be viewed by anyone. (Participants rarely used Flickr’s ability to limit access to designated others. They were more likely to simply not upload such images to Flickr at all.)

Our current research is aimed at Flickr users, including but not limited to cameraphone users. Some participants report using Flickr primarily for themselves: as an archive, often as a back-up for their hard drive, or as a repository for their best images. But others use Flickr primarily for sharing, uploading images that they think others will find interesting, and sometimes participating in thematic groups of people they didn’t know offline.

DISCUSSION

Three of our most striking findings, to us, were: (1) the frequent image-making, including the personal chronicling, to capture the flavor of daily life for oneself and others; (2) how frequently and easily people incorporated the cameraphone into their on-going communicative activities, creating and sending transitory and indexical images, and embedding images and their URLs into their other communicative media; and (3) the users, many of whom described themselves as “not a photographer,” who became avid self-expressive photographers. Finally, we were interested in the reports that former MMM2 users were

moving to Flickr, and seeing it as playing a similar role in their lives.

Cameraphones were not used simply to substitute for other kinds of cameras. Many users told us that the cameraphone was transformative, radically changing the place of images their daily lives. Others adopted cameraphones and MMM2 in a taken-for-granted way, as near-invisible daily tools.

Social Uses

Our social constructivist approach led us to expect that people would use cameraphones in ways both similar to “regular” cameras, and different, as they found new ways to use images in prior, on-going activities. Indeed, we found that cameraphones both replicated and extended the social uses of personal photos. Cameraphones were used for *personal and collective memory* similar to other cameras. In addition, however, we saw personal chronicling and experience sharing. Images were also used as short-term reminders for self and others.

Second, cameraphone images were used for *relationship creation and maintenance*, in the content, the act of taking, and the sharing of images. We saw increased communicative use of images, as described above, functional, affective, and mixed, including transitory, indexical images. Picture-taking became a frequent part of the students’ social activities.

Third, many participants reported an increase in *self-presentation and self-expression*: artistic, humorous, experimental image-making; and increased posting and sharing of images. Some also reported increased photographic seeing: seeing the world in terms of images.

Multimodality

Multimodality refers to the use of a multiplicity of modes, especially text and images. The argument is made is that different modes have different representational potentials and different social practices and meanings. Kress [22] uses the phrase “aptness of mode” to describe the fit between the mode and both that which is represented and the audience. He and other scholars in linguistics, in particular, argue that new media enable increased multimodal communication and flexibility in the choice and combination of modes, and that this is an important trend in contemporary society.

From our findings, it appears that cameraphones (especially in combination with the Internet as in MMM2) encourage multimodality even more than digital cameras. We saw considerable multimodal communication, images being sent with and without text. We also saw other forms of multimodal activity, such as life chronicling, wherein the text-based diary was complemented or replaced with the photographic chronicle. The discussions about multimodality in linguistics and new media studies are not generally grounded in empirical data; here we have

evidence that, given the opportunity, people do indeed engage in multimodality.

Heterogeneous Networks

We described the importance of the concept of heterogeneous networks in social constructivist approaches to technology. Here we see how cameraphone users integrated cameraphones and images into their network of communicative and memory practices and technologies. Unlike the reports we got from other cameraphone users, who had problems with both getting the images off the phones and using them, MMM2 was well-integrated with the Internet, allowing users to easily slot images and image URLs into their on-going communicative practices.

By integrating not only the technology but the users, working with a group that was both socially and technologically-connected, the MMM2 network was truly a network of technology *and* people.

The Migration to Flickr (and Other Image-Based Social Networking)

We are early in our study of Flickr.com, which was inspired in part by the evidence that MMM2 users are migrating to Flickr. We are also following the use of photographic images on popular sites including MySpace.com and Facebook.com. Our findings that MMM2 images were being used for relationship creation and maintenance, including “distant closeness,” are consistent with the increased uses of images on these sites for these same purposes.

Concerns: Identity, Privacy, and Agency

A key issue in cultural studies is the construction and negotiation of identity, which includes our understanding of ourselves as well as our identity in the eyes of others. We and others [28, 28] optimistically concludes that new technology will allow less powerful groups to represent themselves rather than be represented by others.

Cameraphones allow us to make more varied images, more often, under more circumstances. We saw not only many self-portraits, but many casual pictures of self and others. The Internet and other electronic media reduce the boundaries between various parts of our lives. With online sharing, personal photos were once private, can now be quite public. Cameraphones, by their ubiquity, casualness, and potential for surreptitiousness, cross these boundaries even more readily.

Agency has long been a concern with photos because the subject is usually not the photographer. (Barthes [4] talks about a portrait-photograph of himself as related to four versions of himself: the person he thinks he is, who he wants others to think he is, who the photographer thinks he is, and the person the photographer makes use of to exhibit his or her art.) The more public the image, the greater the concern because the greater the potential impact of the image. Digital cameras generally, and cameraphones in particular, mean that images of ourselves that we may not

like, may not even know about, and may not wish to be made public, can be made, posted, re-posted, emailed, and take on a life of their own. We argue here that the importance of this is its impact on our construction of self, self-representation, and impression management, by crossing boundaries and reducing the agency of the person in question. Privacy, we argue, is a question of agency: do I have the power to determine how I am represented, by whom and how I am seen?

Figure 7 is two public images. Figure 7(a) is a still from a video on YouTube.com, Figure 7(b) is a public cameraphone image on Flickr (neither are by MMM2 participants). Conceivably, none of the people depicted would want these images to be public.

CONCLUSIONS

We gave cameraphones and MMM2, an Internet-based service for automatically uploading images and facilitating sharing, to a closely-connected network of older students (average age 29). They had the technology for long enough, between four and ten months, for use stabilize as the technology shifted from novelty to daily device. Such longer-term studies are essential to finding out how people adapt new technology to incorporate new technologies into their on-going activities, adapt the technologies to suit their interests and goals, and integrate them with their technology use and practices, as well as how they develop new uses and new goals and purposes: the co-construction of users and technologies.

We conclude that the cameraphone, especially when networked, may be seen as three different though related devices: *a memory-capture device, a communicative device, and an expressive device*. They were used in ways both consistent with and different from other personal photography, to both support and extend the four social uses of personal photography that we had identified earlier: creating and maintaining relationships; constructing personal and group memory; self-representation; and self-expression. Here we found that cameraphones recapitulated but also extended and changed the balance among these social uses.

In particular, we found increased personal chronicling and “distant closeness,” considerable communicative use of images, functional and affective, short-term and longer-term; and significant self-expression and self-representation. We found that, given the opportunity, participants did indeed engage in multimodal communication and memory-creation.

One reason for the relative success of these networked cameraphones (among at least some of our users) was the ease with which these images could be integrated into users’ heterogeneous networks of people, technologies, and practices, related to image-making and other activities as well.

Images raise particular concerns about privacy because of the recognizability of people in images, and the frequent lack of control by the people depicted. New uses of images that make them more public, especially on the Internet, require that we examine carefully issues of privacy and agency.

Finally, for our larger project of understanding the appropriation and redesign-in-use of new technology, these findings confirm the value of looking at emerging technologies in terms of higher-order, more enduring purposes for related technologies (here, the social uses of personal photography) as well as looking at emerging uses as indicators of other purposes or goals (personal chronicling uses of images and traditions of diary-keeping; identity creation; impression management).

NOTES

¹ The phones were provided by Nokia, and the service was provided by xx. Will be completed.

² Few participants reported taking videos, and MMM2 initially could not handle videos.

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REFERENCES

1. Picture messaging: Lack of textual appeal. *The Economist*, 380, 8489 (Aug. 2006) 56.
2. Aoki, P. M., Szymanski, M. H., and Woodruff, A. Turning from Image Sharing to Experience Sharing, in *Workshop on Pervasive Image Capture and Sharing, 7th International Conference on Ubiquitous Computing (Ubicomp '05)* (2005).
3. Balabanovic, M., Chu, L. L., and Wolff, G. J. Storytelling with digital photographs, in *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (2000), ACM Press, 564-571.
4. Barthes, R. *Camera Lucida: Reflections on Photography*. Hill and Wang, New York, 1981.
5. Bijker, W. E., Hughes, T. P., Pinch, T. J. *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology*. MIT Press, Cambridge, 1987.
6. Bourdieu, P. *Photography: A Middle-Brow Art*. Stanford University Press, Palo Alto, California, 1996.
7. Chalfen, R. *Snapshot Versions of Life*. Bowling Green State University Popular Press, Bowling Green, Ohio, 1987.

8. Clarke, A. E. *Situational Analysis: Grounded Theory After the Postmodern Turn*. Sage Publications, Thousand Oaks, Calif, 2005.
9. Davis, M., Van House, N. A., Burgener, C., Perkel, D., King, S., Towle, J., Ahern, S., Finn, M., Viswanathan, V., and Rothenberg, M. MMM2: Mobile Media Metadata for Media Sharing, in *CHI '05 Extended Abstracts on Human Factors in Computing Systems* (2005), ACM Press, 1335-1338.
10. Engeström, Y., Miettinen, R., Punamaki-Gitai, R. L. *Perspectives on Activity Theory*. Cambridge University Press, Cambridge; New York, 1999.
11. Frohlich, D., Kuchinsky, A., Pering, C., Don, A., and Ariss, S. Requirements for Photoware, in *ACM Conference on Computer Supported Cooperative Work* (2002), ACM Press, 166-175.
12. Glaser, B. G., Strauss, A. L. *The Discovery of Grounded Theory: Strategies for Qualitative Research*. Aldine Publishing Company, Chicago, 1967.
13. Goffman, E. *The Presentation of Self in Everyday Life*. Doubleday, Garden City, New York, 1955.
14. Harper, D. Talking about pictures: a case for photo elicitation. *Visual Studies*, 17, 1 (2002) 13-26.
15. Ito, M. Intimate Visual Co-Presence, in *Workshop on Pervasive Image Capture and Sharing, 7th International Conference on Ubiquitous Computing (Ubicomp '05)* (2005).
16. Ito, M. Introduction: Portable, Personal, Pedestrian. In Ito M., Okabe D., Matsuda M. (eds.). *Personal, Portable, Pedestrian: Mobile Phones in Japanese Life*. MIT Press, Cambridge, Mass, 2005.
17. Kim, J. and Zimmerman, J. Cherish: smart digital photo frames for sharing social narratives at home, in *CHI '06: CHI '06 Extended Abstracts on Human Factors in Computing Systems* (2006), ACM Press, 953-958.
18. Kindberg, T., Spasojevic, M., Fleck, R., and Sellen, A. I saw this and thought of you: some social uses of camera phones, in *Extended Abstracts of the 2005 Conference on Human Factors and Computing Systems* (2005), ACM, 1545-1548.
19. Kindberg, T. et al The ubiquitous camera: an in-depth study of camera phone use. *Pervasive Computing*, 4, 2 (2005) .
20. Kirk, D., Sellen, A., Rother, C., and Wood, K. Understanding photowork, in *CHI '06: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (2006), ACM Press, 761-770.
21. Koskinen, I., Kurvinen, E., Lehtonen, T.-K. *Mobile Image*. IT Press, Helsinki, 2002.
22. Kress, G. Gains and losses: New forms of texts, knowledge, and learning. *Computers and Composition*, 22, 1 (2005) 5-22.
23. Law, J. Notes on the theory of the actor network: ordering, strategy, and heterogeneity. Available at <http://www.comp.lancs.ac.uk/sociology/soc054jl.html>.
24. M:Metrics. M:Metrics Press Release: M:Metrics: Captured by camera phones: Photo messaging climbs as camera phones snap up market share. Available at <http://www.mmetrics.com/press/PressRelease.aspx?article=20060807-photo-messaging>.
25. Okabe, D. Emergent Social Practices, Situations and Relations through Everyday Camera Phone Use, in *Proceedings of Mobile Communication and Social Change, The 2004 International Conference on Mobile Communication in Seoul, Korea, October 18-19, 2004* (2004).
26. Okabe, D. Social Practice of Camera Phone in Japan, in *Workshop on Pervasive Image Capture and Sharing, 7th International Conference on Ubiquitous Computing (Ubicomp '05)* (2005).
27. Rose, G. Family photography and domestic spacings: a case study. *Transactions of the Institute of British Geographers*, 28 (2003) 5-18.
28. Slater, D. Domestic photography and digital culture. In Lister M. (ed.). *The Photographic Image in Digital Culture*. Routledge, London, 1995.
29. Sontag, S. *On Photography*. Picador USA; Farrar, Straus and Giroux, New York, 1977.
30. Spence, J., Holland, P. *Family Snaps: the Meaning of Domestic Photography*. Virago, London, 1991.
31. Van House, N. A. Distant closeness: Cameraphones and public image sharing, in *UBICOMP '06 PICS Workshop* (2006).
32. Van House, N. A. Interview viz: visualization-assisted photo elicitation , in *CHI 2006 Extended Abstracts* (2006), ACM Publications.
33. Van House, N. A. and Davis, M. The social life of cameraphone images, in *UBICOMP '05 PICS Workshop* (2005).
34. Van House, N. A., Davis, M., Ames, M., Finn, M., and Viswanathan, V. The Uses of Personal Networked Digital Imaging: An Empirical Study of Cameraphone Photos and Sharing, in *CHI '05 Extended Abstracts on Human Factors in Computing Systems* (2005), ACM Press, 1853-1856.
35. Voida, A. and Mynatt, E. D. Six themes of the communicative appropriation of photographic images, in *CHI '05: Proceeding of the SIGCHI Conference on Human Factors in Computing Systems* (2005), ACM Press, 171-189.