How and Why People Use Camera Phones

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This paper presents an in-depth study into how people use their camera phones. Using a combined method of interviews and grounded discussions around a sample of actual photos, the study examined people's intentions at the time of capture and subsequent patterns of use. The result is a 6-part taxonomy describing the way images are used both for sharing and personal use, and for affective and functional use. The implications of these findings for future products and services are discussed.

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ABSTRACT

In this paper we describe an in-depth study into how people (adults and young people) use their camera phones. Using a combined method of interviews and grounded discussions around a sample of actual photos, we look at people's intentions at the time of capture, subsequent patterns of use, and desires for future technology. The result is a 6-part taxonomy which provides a framework for describing the way images are used both for sharing and personal use, and for affective (or emotional) reasons and functional use. On the basis of this framework, we discuss the value of camera phones and point to ways in which future design may encourage its emerging value.

Author Keywords

Camera phones, multimedia messaging, mobile phones, cell phones, user research, taxonomy

ACM Classification Keywords

H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION

There is no doubt that the worldwide boom in mobile phone penetration has forever changed the global technology landscape as we move into the new millenium. As mobile phone operators look to capitalize further on this huge market, there are high hopes that, following on from the success of text messaging (especially in Europe and Asia), the next wave of mobile services will center on "picture messaging", also known as "MMSing" or multimedia messaging services. In particular, there are hopes that the support of picture messaging using mobile phones with integrated cameras will establish photographic images as a new genre in mobile communication.

Indeed, there are some grounds for optimism. Recent statistics in Japan report camera phone sales now exceed 50% of the mobile phone market, with major operators such as J-Phone reporting over 70% of customers subscribing to MMS. Predictions are that worldwide sales of camera phones will reach nearly 150 million units in 2004, or a quarter of all mobile phone sales [4].

However, while sales figures are good for the units themselves, what is not so clear is the extent to which camera phones are actually used for sending picture messages. Recent media reports have described early results for many of the mobile operators as disappointing, with forecasters downgrading their original estimates for MMS revenues [15].

There could be many explanations for this. It could be that camera phones are purchased simply because they are the "latest thing", it being important for many people to be seen to have the most up to date model of mobile phone. It may be that people like the idea of sending picture messages in principle, but find a number of obstacles to use. Cost is an obvious factor here, especially when weighed against the perceived value and difficulty of use. Those may be rooted in the design and implementation of the device or service, such as difficulty in using a phone's MMS capabilities, disappointment in the quality of the images, and so on. Alternatively, it may simply be a lack of critical mass – that picture messaging is yet to fully take off and establish itself as a new genre [9]. Or, it may be an indication that the inherent value of camera phones does not lie in the sending of images, but in doing other things with captured images.

When it comes to understanding what users actually do with their camera phones, there appears to be little in the way of in-depth data based on actual use. If camera phone users are not "capturing and sending", then what is a more realistic picture of what they *are* doing? Are people using them essentially as digital cameras, or are they enabling new forms of interaction? Are they using them as a way of sharing images with others, or are they using them primarily as personal "capture and carry" devices?

If we can understand how people are currently using these devices, and explore their potential value in terms of what people *might* want to do, not only may we have a better line of sight into the future, but we may be able to help steer that course, developing devices, applications and services that people will truly value. That was the goal of this study. More specifically, there were three main aims:

❑ *To Explore the Range and Diversity of Use.* Understanding the many reasons why people capture images on camera phones, as well as the range of ways in which such images are used, may broaden our outlook with regard both to the current utility of these devices and their future prospects.

- *To Elucidate the Characteristics and Context of Use.* Understanding the characteristics and context of use for different kinds of activities may suggest new features and new technologies that could better support any particular activity. This includes understanding the "life cycle" of usage from capture or receiving of photos through to eventual deletion or archiving. It also includes an exploration of any barriers to use that people encounter in the course of this life cycle.

- *To Probe Future Uses and Desires.* Asking users about their desires with respect to future use may be an additional source of information to help us uncover what new kinds of technologies might be valued in future.

Further, because previous research suggests differences in mobile phone use both in terms of geographic region and age of users (e.g., perpetual contact book), we decided to select subjects from both the UK and the US, and amongst both an adult and a younger population. We drew on these different populations mainly to capture range and diversity of use rather than to systematically explore differences between them.

PREVIOUS RESEARCH

Most of the small body of literature in this area concerns the use of camera phones for the sending of images to others, rather than the range of ways in which camera phones are used. One of the earliest studies in this regard was the "Maypole" study [12], a European Funded project. Carried out prior to the release of commercial camera phones, Maypole provided small groups of users with prototype devices and looked at the sending behaviours of two socially connected groups of people. The study showed how participants sent images to increase or maintain group cohesion, express affection, support conversation, and tell stories. Similar results were found in a study carried out by the Finnish telecommunications company Radiolinja [6].

More recently there have been a number of studies looking closely at the types and context of communication carried out via multi-media messaging (MMS). This includes the use of camera phones for work-related communication [11], for aspects of domestic communication such as problem-solving and time management [1], and for teasing [8]. Further, much of this research has discussed the ways in which people design their messages, including the ways in which text is used in conjunction with images [7] and how images can enrich text [12,8].

One issue about which there appears to be some disagreement is whether or not images are more or less ambiguous than text. One researcher [1] argues that images are more effective for communication as they overcome the semantic ambiguity of the written word, whist others claim there is in fact more room for misinterpretation through MMS: either one needs a great deal of shared context between sender and receiver [10], or text is needed to help disambiguate a message [6]. On the same theme, [2] discusses the ways in which the exchange of images can be seen as collaborative "performances".

Although these studies provide rich, detailed data, there is little research which explores uses beyond capturing and sending images with camera phones. Exceptions to this are mainly indications of other kinds of activities that camera phone users carry out. For example, the 'Maypole' study [12] found that participants began to capture everyday items and use them in funny ways or to make stories, often sharing the images on the cameras themselves. In some cases, users expressed their desire to want to keep such images longer term and also to print them.

Ito [5] also discusses how the camera phone is changing what is considered noteworthy or newsworthy, spanning 'a broad spectrum from personally noteworthy moments that are never shared (a scene from an escalator) to intimately newsworthy moments to be shared with a spouse or lover (a new haircut, a child riding a bike).' In another study, [1] discusses the phenomenon of 'local interaction' with camera phones which are used as portable photo albums, passed between and traded with co-located people. However research in this area is sparse, with little more than a few anecdotal reports of such behaviours mentioned in passing in published papers and the media.

The study we report here examines the whole range of activities that constitute camera phone usage. Further, unlike previous research focussing on groups of individuals known to one another, we recruited a wider cross-section of individuals most of whom were experienced camera phone users.

METHOD

The approach we adopted in this study revolved around the collection and examination of actual images captured or received by camera phone users, combined with in-depth interviews. This methodology gives us detailed, grounded data about real usage patterns coupled with users' own interpretations of their activities as well as their more general perceptions and opinions.

Subjects

In all, 34 subjects were recruited by sending out email advertisements within our own research organisations asking for volunteers amongst friends and family. Community bulletin boards and posters displayed at local high schools and colleges were also used in order to recruit younger users. "Youths" were classified as between the ages of 16-21, while adults were classed as over 21. Selection criteria were minimal: subjects had to have owned camera phones for a minimum of one month and had to use them to take a minimum of 5 images a week. These images could be photos or videos, recognizing that many camera phones now have the capability to capture short video segments.

In total we recruited 9 youths and 10 adults in the UK (mainly from the Bristol or Cambridge areas) and 4 youths and 11 adults in the US (mainly from the Bay

	UK (n=19)		US (n=15)	
	Male	**Female**	**Male**	**Female**
Youths (n=13)	6	3	2	2
Adults (n=21)	7	3	5	6

Table 1. Breakdown of subjects by geography and age.

Area). The breakdown of males and females falling into each category is shown in Table 1.

Subjects were reimbursed for images sent during the course of the study, plus were given either a shopping voucher or a mobile phone "top-up" card. While we recognized that paying costs for sending images might distort the usage data, we were interested in what people would use picture messaging for, if unfettered by concerns about money.

Procedure
The study consisted of two interviews, separated by two to five weeks (or after they had taken at least 10 additional images with their camera phones).   Subjects were asked to bring their camera phones to both interviews and were told that we would like to look at and discuss a random selection of the images they had on their phone. For privacy reasons, we did not ask them to pass the phone to us; instead, we asked them to show us whatever images appeared every few clicks on the phone's image browser, as long as they were acceptable for our viewing. They were asked not to delete images on their phone before the interviews, except for privacy reasons.

The first interview involved the collection of background demographic information as well as information about their experience with imaging technologies using both open-ended as well as multiple choice questions. Basic statistics about the images on their phone were also logged. The bulk of the interview was then based on selecting at random about five images on the subject's camera phone. Where the user had a cluster of images (a series of images that were clearly related to one another), we chose only one representative image from the cluster. For each of the selected images, subjects were asked:

❑ What the image showed, where it was kept and whether it was captured or received by the subject.

❑ If captured, the intention behind taking the image and the context within which it was captured. We also asked if they were able to fulfill their intention. If not, we asked why.

❑ If received, when and who sent the image, how it was sent, whether it was annotated, and conjecture as to its purpose.

❑ Details of any uses of the image, including whether it was shared and how, whether it was annotated, its context of use, and intentions with regard to keeping it or deleting it. This included uses which may have been originally unintended.

❑ Any wishes or desires with regard to additional things they would have liked to have done with the image.

In the final interview we: logged basic data on images sent, received and archived since the first interview, examined five more images at random using the same technique in the first interview, probed more deeply for difficulties and perceived value, examined patterns of image-communication with the subject's cohort (friends, family, colleagues), and captured more general data about wishes or desires for future use of the technology.

During both interviews, the discussions were tape-recorded and the interviewers took notes. In addition, subjects were asked to provide digital copies of the images we had discussed on both occasions.

Analysis
We used simple descriptive statistics to summarize the demographic and experience data from the initial interview and the data captured in the final interview having to do with subjects' experiences of use, likes and dislikes, and communication patterns.

The main part of the analysis involved coding the data collected for each image in terms of the content of the images, the context of capture (or receipt) of images, the intention behind capture, the context and details of use, and the desired uses. For each different aspect of the data, we devised a classification scheme which we felt best captured its nature and helped to describe its diversity. It should be noted that these categorization schemes were not tested for validity through independent coding. This is because we were aiming for collaborative agreement on what constituted sensible categories, for example, of intention or use of images, in order to build a framework for understanding the data rather than to prove any *a priori* hypotheses.

Once coding schemes were agreed and iteratively modified, each image was coded by listening to the taped interviews. Any problems with coding particular cases were discussed with the other interviewers. Interesting or representative comments were transcribed verbatim.

RESULTS
We will begin by briefly summarizing some of the demographic and background experience of the subjects before moving onto the details and findings in relation to the images we discussed. The bulk of the findings relate to subjects' intended use as well as actual use of their camera phones and the characteristics of these different kinds of activities.

General Demographics and Technology Use
As shown in Table 1, of the total of 34 subjects, 22 were adult users (11 in the US and 10 in the UK) with the

majority in the age range 22-30 and 31-40 years old. Amongst the younger subjects, 4 were from the US and 9 from the UK with an age range of 15 to 21. Although, we had aimed for parity in the numbers of adults and young people, we had difficulty in recruiting the latter, or more particularly getting them to appear at agreed times and places. As it was, two of our young subjects in the UK never showed up for a second interview, but we include the data from their first interviews anyway.

Subjects used a variety of types of camera phone and service providers. Some had owned mobile phones for many years (14 years at most, and 4.7 years on average) and had upgraded to camera phones anywhere from 1 to 24 months previous to the study (on average 8.6 months). In these aspects, there was little difference between the US and the UK although the UK subjects had owned a camera phone for slightly longer on average (9.2 versus 7.9 years). In general, US subjects and UK adult subjects were on monthly plans, while UK youth used pre-paid plans.

Most of the phones had VGA resolution cameras (640 x 480 pixels), without a zoom or flash. Only nine of the 34 phones had the capability to take video clips, and only six of the subjects reported using this feature on a regular (weekly or monthly) basis. All but three of the subjects had access to a multi-media messaging service for sending images from their phones. All but five had (or thought they had – not everyone was sure) GPRS service enabling web and email access, but this service was infrequently used. Some additionally had infrared or Bluetooth as a means of transmitting images directly to other phones, but only six subjects reported non-negligible use of these facilities.

All of the subjects had access to a PC at work or school and all but 3 had access at home. Many subjects also owned and used other types of imaging devices in addition to their camera phones. Most owned and used either a conventional (film) camera (22 of 34) or a digital camera (27 of 34) but less than a third reported owning and using a video camera (11 of 34). Use of conventional cameras and video cameras was infrequent, with only a few people reporting using them more than once a month. Digital camera use was more pronounced with most subjects using them at least monthly.

It was clear from the comments that both digital cameras and conventional cameras were used when there was a need for higher quality photos, such as at special events, and when there was a need to show printed pictures. Camera phones tended to be characterized as more for "spur of the moment" kinds of photos, its use as a spontaneous capture device and the ability to send from it making it a different kind of tool.

General Camera Phone Use Statistics
Looking at the images on subjects' phones at the time of the first interview, most were photos that subjects had captured themselves rather than received from other people, and almost all were photos as opposed to videos. On average, subjects had 44 images on their phones that they had captured themselves. However, there was large

variation in this respect (SD=53). In terms of images received from other people, subjects had a mean of only 2 photos. About a quarter of the subjects also had captured and received videos although, for those subjects who could capture video, on average they had only about a third as many of these as they had photos.

By the time of the second interview, subjects had acquired an additional 24 photos on average, again with a large variation (SD=27). Five of the subjects had also acquired a few videos.

These general statistics can be looked at in more detail by combining data from the first and second interviews to look at the whole life cycle of activity:

> *Capturing:* Most subjects reported in the initial interview that they captured photos on average several times per week. Based on actual numbers, we found that the average rate of actual photo capture between interviews was the equivalent of about 8 photos a week or 34 a month. For those with video capability, the video capture rate was much less than for photos: about 3 videos every month.

> *Receiving:* The number of images received by subjects in the course of the study was lower than we might expect on the basis of their general responses. Most subjects reported receiving photos on their camera phone at least several times a month, typically by MMS although email was available to some on their phones. However, overall, the average rate of receipt of photos was about 2 photos every month. There was negligible sending or receiving of videos between the two interviews.

> *Sharing:* Most image-sharing took place face-to-face, almost always on the phone's screen but sometimes by direct phone-to-phone transfer over infrared or Bluetooth, and by MMS. When it came to sharing with remote users, the subjects used a variety of methods to send images. In all, 31 subjects reported in the initial interview that they habitually sent photos directly from their camera phone -- primarily by MMS (22 subjects) but also by phone-based email (12 subjects). In addition, 12 subjects reported that they would sometimes send their photos by first uploading them to their PC and then emailing them – usually because either they were unable to configure or use the sending services on their phone or because the recipient did not have a phone capable of receiving images. However, only 23 subjects actually sent any photos in the course of the study, which was somewhat surprising especially as we were covering their costs and in light of the fact that the course of the study covered anywhere from 2 to 5 weeks. Looking at all 34 subjects, the average rate of sending photos directly from the camera phone during the study was equivalent to about 8 photos a month. (However, one younger subject
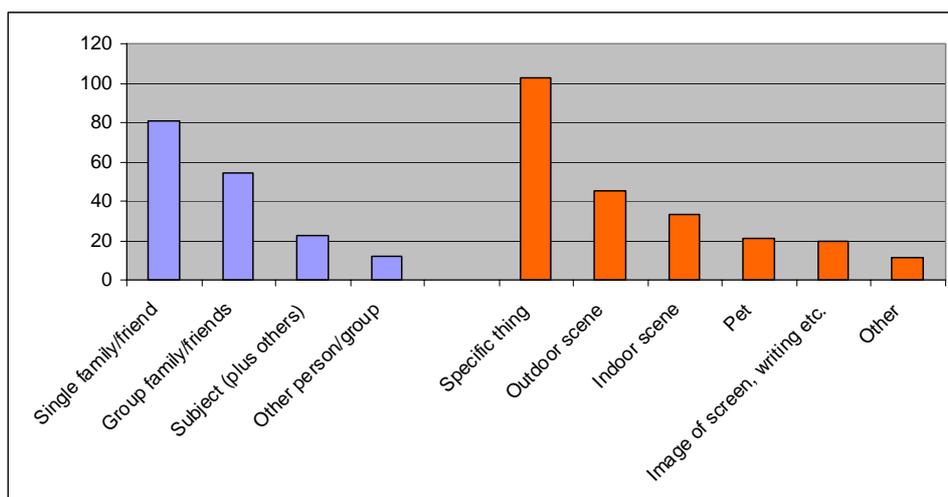
Figure 1. Number of images by category of subject depicted.

had a very high rate of sending and as such was an outlier. Discounting that subject resulted in a mean sending rate of about 6 photos a month.)

➢ *Printing:* Only 12 subjects reported that they printed photos captured or received on the phone, and most of those said they did so only a few times a year. We recorded only one instance of printing, in this case one subject reported sharing an image by sending a print in a letter along with a thank you note for a gift previously received.

➢ *Archiving:* With regard to archiving, 18 subjects reported that they uploaded their photos to their PC either several times per week or per month. Consistent with this claim, the average rate of archiving between the two interviews was about 15 photos per month (there was no video archiving).

Description of Examined Images
From the repositories of images (both photos and videos) subjects had on their camera phones at both interviews, we randomly selected about 10 as the basis for our discussions (five in each interview). In total, across all subjects and interviews, we collected data on 303 photos and 17 videos, or an average of 9.4 images per subject. Of these, less than 8% were images that were received: 295 or 92% of the images we examined were captured by subjects' camera phones.

The images depicted a range of subjects. Figure 1 shows the frequencies of what was captured by type, although sometimes two types of subject occurred in a single image. The most frequent were images of people, comprising 161 images or 51% of the total. Of those, 81 were of a single family member or a friend, 54 were of a group of family members or friends, 23 contained the subjects themselves (alone or in combination with other categories) and 12 were of an unrelated person or an unrelated group.

Of the images containing subjects other than people, the most frequent were the 103 or 32% of images that contained a specific thing, e.g. a rare book, a car, flowers, a shopping item, food eaten, or a building. In addition, 45 images represented outdoor scenes (like a landscape or a city scene) and 33 represented various indoor scenes (like domestic or work settings). There were 21 images of pets and 20 images that were taken of writing or another image, in printed form or on a screen.

While the content of these images tells us something about what our camera phone users tended to capture, more generally, it is the stories behind these pictures – why they were taken and how they were used—which gives us the real insights into the value of camera phones. For example, people took pictures of specific objects sometimes as a form of evidence (e.g. a dent on a car), sometimes as a memory aid (e.g. when shopping), or sometimes as part of a special personal message (e.g. a photo of some roses with a wish for a speedy recovery sent to a person who was not feeling well). It is to this deeper analysis that we now turn.

A Taxonomy of Reasons for Capture
We now look at the various reasons *why* subjects said they captured images with their camera phones. We focus on captured rather than received images, not only because they represent the majority of images, but also because we can only speculate as to the intentions behind received images. At this point, it is the intentions behind capture in which we are interested. These we extracted and classified by analyzing the tapes of the interviews associated with each of the 320 images.

Considering the whole corpus of captured images, there were broadly two different dimensions along which subjects' intentions at capture varied. The first dimension was whether images were taken for "affective" versus "functional" reasons. Here, we take affective to mean images which were captured for some sentimental or emotional reason, whether this means joking or showing affection for someone else, or capturing an image which

	Social				Individual	
Affective	**Mutual Experience.** Images used to enrich a shared, co-present experience (either in the moment or later as a memento).	103 (35%)	**Absent Friends or Family.** Images used to communicate with absent friends or family (either in the moment or later).	63 (21%)	**Personal Reflection.** Images used for personal reflection or reminiscing.	120 (41%)
Functional	**Mutual Task.** Images shared with people co-present in support of a task (either in the moment or after the event).	11 (4%)	**Remote Task.** Images used to help accomplish a task by sharing with remote family, friends or colleagues (either in the moment or later).	23 (8%)	**Personal Task.** Images used to support some future task not involving sharing.	29 (10%)

Table 2. A taxonomy of image capture, showing numbers and proportions of images by category.

evokes some sort of emotional reaction in oneself. Functional images, by contrast, were those taken to support a particular task. Such intentions were more pragmatic or practical in nature.

The second dimension was that of "social" versus "individual" intentions. Here, social intentions included all those cases where subjects reported capturing images in order to enhance or support sharing with other people. Individual intentions were those in which subjects captured images purely for personal use (i.e., not involving sharing with anyone else).

Further, when we look more closely at social uses, these can be broadly broken down into sharing with people who were *co-present at the time of image capture* and sharing an experience related to the image versus sharing with people who were not physically co-present. As we shall see, this dimension helps explain differences in how and why images were shared.

This broad breakdown results in the six categories shown and defined in Table 2 along with the total frequency of images falling into each category. The numbers sum to more than 295 (the number of captured images) because there were sometimes two distinct intended uses for each image. (In the very few cases where there seemed to be three separable intentions, we coded only the first two reported.) Of the 295 captured images, 78% had one purpose reported and 22% had two intended purposes.

The first point to note is that affective reasons for image capture clearly outweighed functional reasons -- 84% as against 19% of the images. (Just 3% of the images were captured with one affective intention and one functional intention. In those figures we have avoided the double-counting that would occur if we simply added the numbers in Table 2.)

A second point is that the majority of images were captured with some kind of sharing intended (65%), leaving a substantial proportion that were captured with no such intention (35%). However, 15% were captured with an individual intention in addition to a social intention. Most of those images were affective in nature,

usually because images captured for personal reminiscing were sometimes also intended to share with family or close friends.

Let us now examine the six different categories in Table 2 in more detail. We first consider the affective categories.

Affective Categories

Mutual Experience
The most common social reason for capturing an image was to enrich a mutual experience by sharing an image with those who were co-present at the time. This could be done in essentially two ways: by enhancing the shared moment, or by sharing an image later on as a memento of something experienced together.

Unsurprisingly, most images in this category were of an individual or a group of people, although sometimes there was an object that was somehow relevant to the moment. The images were mostly captured in a public venue such as a pub or restaurant, or in a more private place like a friend's house or at a party or function. Many were also taken when the subject was out and about on a holiday or trip with companions.

(a)   (b)
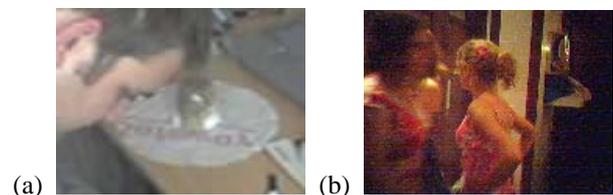
Figure 2. Images taken for teasing (a) and as a party memento (b).

For most images (59%), this was a case of "enhancing the moment" where taking a picture and sometimes sharing it immediately was a way of showing the value placed on an experience. Sometimes the picture-taking was almost a social end in itself: "We were swapping phones and taking pictures of one another -- using one another's phones as well." But mostly the images were about a

Figure 3. Images shared with those who were absent: muddy conditions at Glastonbury festival (a); completed building work (b); teasing about a desired object (c); and riddling (d).

specific occasion. The motives ranged from joking and gentle provocation to a more straightforward celebration of being together. The image in Figure 2(a) is quite grainy and indistinct, and the young man in it is not actively participating in the photograph, however it shows a friend engaged in making a parachute out of a plastic bag. The subject jokingly took the photo as a way, she reported, of "embarrassing her childish friend". In this case, the significance of the image is directly tied to the mutually experienced event.

The other main way images were shared in this category (48%) was as a memento shown on the phone or sent after the event. For example, the image in Figure 2(b) was taken as a memento of a "hen night", a traditional party given for a bride-to-be (the "hen") by her female social circle. It was taken to show the hen herself, who is in the centre of the picture. Another subject took a picture of his wife and mother together on a trip, and later emailed the image to them. Many other images of family and friends were of this sort, where photos of shared events were captured in order to show or send to the people present at a later time.

While these were the main intentions behind these images, instances falling into this category exhibited the most diversity of actual use among all the six categories.

It was very common for these kinds of photos to be shown on the camera phone to people co-present at the time of capture. This was the case for two thirds of the images we examined, suggesting this was a key aspect of enhancing the moment. In only one case, however, was an image sent to others co-present at the time of the event. Many of the images intended as mementos were discussed as things they would send in future but hadn't had a chance to yet. The implication here was that the time and effort one must put in to sending these "gifts" was difficult or inappropriate to achieve in the moment. Sending was therefore put off until later.

However, here we also saw that poor image quality could be an issue. About a fifth of the images were classed as "throwaways" in that subjects talked of the intention to delete them. Indeed, this number may be higher in

actuality as some may have been deleted by the time of the interview. However, for those images that subjects had not yet deleted, about a third were to be kept indefinitely on the phone and there was an expressed intention to store on average about half of them longer term on a PC or (occasionally) the web. That points to the importance of being able to easily archive many of the images falling into this category.

In addition to these intended uses, there were other unanticipated uses, however. First, about a third ended up being shared later with people who were *not* present at the experience, presumably because people sometimes naturally want to relate stories about certain experiences to others – those, for example, who know some of the people involved. And since camera phones are carried around almost everywhere, unforeseen opportunities for sharing arose. Second, about a fifth of the images were also used as personal keepsakes where subjects would revisit and reminisce on their own instead of with others. So it seems that the camera phone was used much like a photo "flipbook" which was always to hand. As such, there were many unanticipated uses of these images because of their personal and social significance.

Absent Friends or Family
Images in this category were different from the previous category in that the intention was to share or communicate an experience with *absent* people. Again, this could happen very much "in the moment" in that there was a desire to share an event as it unfolded, or it could happen after the fact.

While people figured in 36% of the images, and about 30% of them could be described as either indoor or outdoor scenes, it is interesting that images in this category were predominantly of specific things (60%) with some shared meaning for the absent person, as Figure 3 exemplifies.

Figure 3(a) shows an example of extending an experience to absent friends: the subject was at a music festival in muddy conditions which she shared in the moment by sending an MMS image of her muddy boots. In this way, her friends could be "brought in" to what she was experiencing, as she was experiencing it. Figure 3(b) is a similar but more pointed example: it is an unremarkable picture of some building work but what it represents is proof, rendered in an affective (joking) rather than strictly task-oriented sense, that the subject had completed something his friends had worked on with him earlier. It was important to share the image in the moment, to communicate the timeliness of the subject's achievement. This use of an image as proof or evidence of something is a theme that crosses several of the categories in our taxonomy.

The next two examples go further in being more about the relationship between the people involved and less about the sharing of a particular experience. The arrival of the box (Figure 3(c)) was communicated in an MMS message as a way of teasing the recipient, who desired the "designer" audio equipment that it contained. Figure 3(d) shows a riddle that one subject constructed to send to her
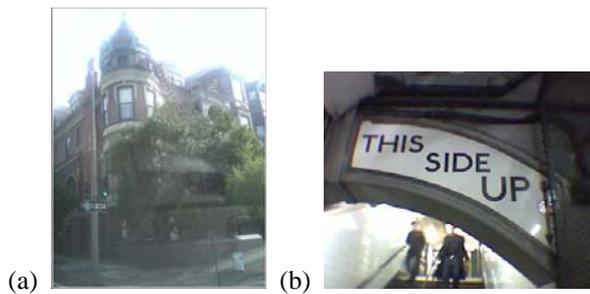
Figure 4. Images showing personal aspiration (a) and signifying a personal achievement in having entered a subway station despite earlier panic attacks (b).

husband, concerning the nature of the gift for him that had just arrived.

It is interesting that many of the images in this category make use not only of shared meaning of objects but also were clearly drawing value from the contemporaneous connection that was possible through the camera phone. While messages received after the fact might still be valuable, drawing someone into an experience happening at the same time despite being separated by distance represented a compelling way to stay close. As one subject put it: "this was a telepresence - she could feel like she [his girlfriend] is here to see it". In all, we found 27% of the images in this category were shared in this way by sending messages "in the moment".

Not only did many such images represent and demonstrate shared history between long time friends or family, but they were also sometimes more tightly woven into an ongoing conversational context made possible by a range of technologies. Again, real-time interactions were part of this. For example, in one case a subject described going out to his garage to take a picture of his new car in immediate response to receiving a friend's picture of his new motorcycle; the pair then had a discussion by phone. We also recorded several cases of users sending picture messages while communicating by email and instant messaging on PCs.

In addition to sharing in the moment, many images in this category were shared after the fact either on the phone itself (38%) or sent later (16%). Most were sent directly from the phone, but a few were sent by email on a PC, via a web page or as a print-out in a letter. This *post hoc* sharing typically involved story-telling after the fact with friends and family who had been absent.

About a quarter of the images were never in fact shared with absent friends and family, despite the initial intention. That was sometimes because the original impulse to share had been lost, but was also because of problems in terms of poor quality of the image and the discovery that a friend could not receive the image electronically for technical reasons.

As with images in the previous category, photos taken for sharing with absent friends and family also often ended up being shared with someone who had co-experienced the event, and were also sometimes used for personal

reflection. Once more, subjects expressed a desire to keep about half of their captured images in this category long-term on a PC. However, the desire to keep these photos was less pronounced than in the previous category, perhaps reflecting a higher proportion of images such as Figure 3(d), which were for giving rather than keeping.

Personal Reflection

This category encompasses those images captured for the purpose of individual reflection or reminiscing and was the largest of our six categories. Here, subjects' comments indicated that portability and the ability to capture and carry such images was important. As one person put it: "It's nice to capture a little moment to carry with you. It's a memento."

In this capacity, such images were often again used like digital "flipbooks" of favourite images, or the images one might keep in one's wallet. Many were carried in order to keep some treasured person or object "close". So, for example, many were of family (e.g., babies), friends, or pets, but also included pictures of gifts of emotional or sentimental value. Other images had associated with them other kinds of personal meaning, such as one woman who carried around a photo of the house she aspired to own (Figure 4(a)), and another (this time a man) who took a picture of a sign at a subway station which signified his having overcome a problem he had had with panic attacks. Previously, these would have affected him where he was standing when he took the picture (Figure 4(b)).

In only three cases were the subjects' original intentions thwarted – in each case due to an inability to take a satisfactory picture of the target as the subject wanted to record it.
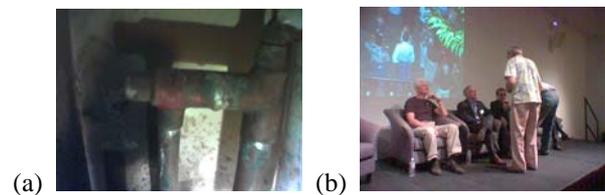
Figure 5. Images showing a plumbing problem to be solved jointly (a) and an event recorded together with notes to be posted on the web (b).

When we looked at additional uses, we found that two thirds of the images were in fact eventually shared, even though originally there had been no intention to do so. About half (48%) were subsequently shared with people who had not been present when the image was taken. In most of those cases (75%), the images were shown to others on the phone, reflecting the opportunistic nature of sharing. In addition, in a substantial number of cases (39%), such images were also sent from the phone or via a PC.

Slightly fewer (40%) were shared with someone who was co-present at the time of capture, usually immediately after they were captured and always on the phone. It seems natural that many subjects who took an affective

8
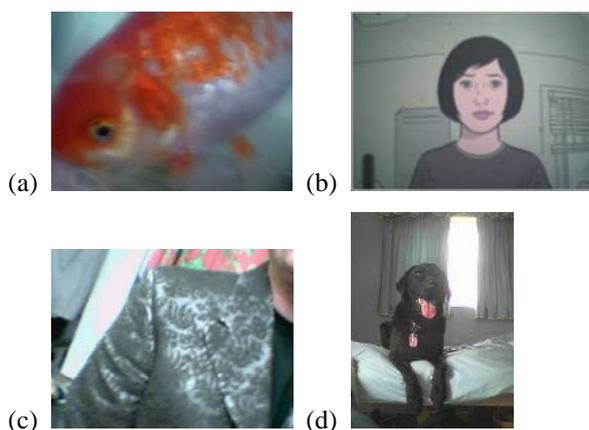
Figure 6. Images used to complete a task with someone who was absent: goldfish to be fed (a); a haircut to take to the hairdresser (b); a candidate style of material for a wedding (c); the dog being looked after is happy (d).

image for personal reasons also felt the need to include their companions at the time by sharing it.

Consistent with the strong affective value that the subjects reported for many of the images in this category, and with their wish to revisit the image or share them with others, in about half the cases the subjects reported that they intended to keep the image on the phone "long term", or until they saved it to a PC. There were about 10 cases of using images for phone "wallpaper" or for associating with friends or family in their contact lists. About half of the images had been or would be saved to the PC.

Functional Purposes

Mutual Task

Turning to more practical uses of images, we first look at images captured in order to complete some kind of task with people who were co-present at the time of capture. This was a small category (comprising just 11 of 295 images). Further, half of the images in this category were involved only in a relatively trivial form of "task" where subjects were demonstrating or experimenting with the functionality of their camera phones. For example, they were showing how the camera phone worked or were comparing their camera phones' ability to capture images in low light or capture printed images. These uses show, on the one hand, the relative unfamiliarity of camera phones as imaging devices and how some subjects therefore felt the need to test the boundaries of their effectiveness. It also shows the willingness of subjects to experiment or "play" with the devices which they have with them during otherwise idle times.

However, the other half of the images were used in some type of bona fide recreational or practical task. Several of those images served as a shared record required in order to discuss something that needed doing, or to capture its state before work began. For example, a couple took a picture of pipes as part of a discussion of a plumbing task, which they later took to a store (Figure 5(a)). A rather different case of a mutual task was where a man took a picture as a record of a computer history museum event in

which he participated, which he later integrated into the minutes of the event, sharing with others who were present (Figure 5(b)).

Remote Task

In this category, images were taken as part of a task shared with people who were *absent* at the time of capture. Again, this was a relatively small category. However, it contained twice as many images as the "mutual task" category, and was a richer source of interesting tasks that people carried out.

Most of the images (77%) were of a specific thing connected with the task. Often such an image was used to tell or remind a remote person about something that needed doing, or discuss it with them. The goldfish in Figure 6(a) was accompanied by the text annotation "feed me"; the subject wanted to remind his daughter to feed the fish while he was away (in fact the sending service failed and he had to resort to phoning her). Figure 6(b) was captured as a sample of a haircut that the subject liked and took with her to the hairdresser. The man who found the jacket in Figure 6(c) sent the image straightaway to a friend who was a husband-to-be, recommending that he should visit the shop to consider attire for the wedding. Another sub-category of these images were used as evidence needed to meet a commitment with an absent person. Figure 6(d) shows the healthy state of a dog that the subject was looking after while its owners were away. Another subject assured his mother he had landed safely, with a picture of the plane being disembarked.

Note that in the above examples, time plays an interesting role. Sometimes images were more effective when shared "in the moment" (such as the photo of disembarking the plane), or at least within some short time window (such as the happy dog example, and the goldfish case). Others were used to capture information to use later, either to share face to face with someone else (the haircut example), or to be used by someone remote (the jacket example).

The importance of time is reflected in the fact that about half of these images were sent rather than shown later to others. This represents the highest sending rate for any category (even slightly higher than "absent friends and family"). The need to send probably comes about because, where there was a task to be carried out, either subjects could not always wait until they saw the other people concerned, or they wanted to discharge their task while they thought of it.

Few of these images were additionally associated with other intentions or uses. In addition, it is not surprising that the subjects had relatively little use for them to remain on their own phones, at least not once they had fulfilled their task-specific purpose.

Personal Task

This, the largest of the functional categories, covers a range of reasons why people took images in order to support some practical, individual task. As we might expect, the majority (about two thirds) of the images in
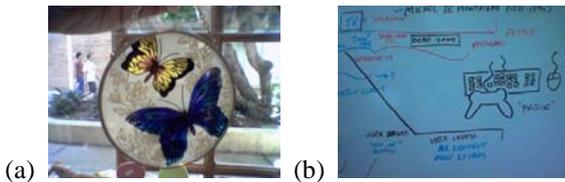
Figure 7. Images captured for individual, functional reasons such as a gift idea (a) and a whiteboard (b).

this category were of specific things involved in a task, although about a third depicted people.

Many of the images in this category were simply cases of individuals experimenting with the imaging capabilities of their camera phones. However, also common was the use of images to record information for later reference. Some examples were in the context of shopping: one woman captured gift ideas while in shops (Figure 7(a)), another captured images of bookcases while comparison shopping. Some examples were more work-oriented, like the image of a painting one woman took at an art gallery that she later referred to in a school project, or the image of a whiteboard (see Figure 7(b)) which one man used to store as a memory aid to remind him of what had been said in a meeting. For some images in this category, detail was quite important such as a car registration number one woman captured when she was involved in an accident. Finally, images as a reference source were sometimes collections: An architect collected detail from buildings to use in an ongoing projects; another man took pictures of objects in scrap yards to use in thinking about future sculptures he might make.

Other functional uses included personal reminders (e.g., one youth took a picture of his friend to remind himself later that he needed to send him a message). Unlike in studies of other kinds of image capture [16], however, there was only one case where an image was taken in order to incorporate it into a document; and there was very little evidence that images were ever modified in any way.

Although the images in this category were intended only for personal use, about two thirds of them were in fact shared with other people either in some affective context or as part of shared tasks. For example, the subject who took a photo of the registration number of the car that damaged hers later used the same photo in telling the story of the incident to her friends.

As with the previous category, most of the images in this category were kept short-term on the phone, mainly until they had served their purpose.

Age, Geography and Gender
While it was not a primary goal of this study to examine demographic differences, we did test for statistical differences for many of our key measures across age (youth versus adult), geography (US versus UK) and gender. There were only a few differences of statistical significance overall:

➢ *Adult vs. youth:* There was a greater proportion of images in the "Mutual Experience" category for youths than for adults (p=0.027). That is, youths used their camera phones more than adults in connection with experiences they shared with other people. Other than this clear-cut finding, there were also indications but no firm evidence of other differences. For example, in terms of proportion, on average, youths shared about twice as many images face-to-face with people who had not been present at the time of capture (37%) as did the adults (19%). They also sent and received more images on average than the adults: Youths sent about twice as many photos per month as adults (a mean of 12.7 versus 5.6 per month among the subjects); the receipt rate for youth was about five times that for adults among our subjects (averages of 4.7 versus 1.0 per month, respectively). Finally, there seemed to be a tendency (p=0.058) for youths to archive images less often than adults (1.7 per month versus 22.3 per month on average). However, none of these findings reached significance.

➢ *UK vs. US:* No differences between the US and the UK samples reached significance in terms of the distribution of images amongst the six categories of intent. In terms of photo sending and receiving rates, whilst UK averages were about four times those of the US (12.2 vs. 3.4 per month for sending and 3.7 vs. 0.8 per month for receiving), neither of these differences reached significance. Similarly, while a higher proportion of the UK sample routinely shared images face-to-face (35% of UK images versus 15% of US images), this was also not significant.

➢ *Male vs. female:* Males captured significantly more images than females in the "personal task" category of intent (p=0.014).

Likes/Dislikes and Future Wishes
We conclude our report on results by summarizing the findings with regard to subjects' likes and dislikes and also their wishes and desires for future changes or improvements to their camera phones or the services associated with them.

This data came from the subjects' free-form responses to a general "likes/dislikes" question, as well as from wishes expressed for each of the 320 images, and the rankings concerning improvements or adding features or services. The final source of data was the answers to supplementary questions about sending and printing, collected via email from 23 subjects.

We found that the main aspect that subjects liked was the "always to hand" nature of camera phones: most of the subjects (27) liked the fact that they could carry the camera phone with them everywhere and thus have it always available. Half of the subjects made positive mention of its ability to capture events and information.
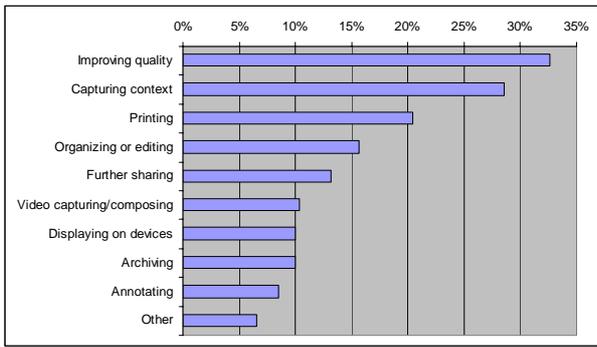
Figure 8. Per-image wishes as percentage of the corpus of 320 images.

However, the data highlighted several aspects in the state of the art that need improvement. Principal among those were image quality and sending and printing capabilities. Most of subjects (27) were not satisfied with captured image quality, and about half of the subjects (16) mentioned the inadequacy of camera phones under poor lighting conditions.

In confirmation, the most frequent per-image wishes were also about better image quality in such terms as better resolution, more control over the image by using a zoom or more favorable lighting through using a flash -- mentioned for 104 of the images (Figure 8). Image quality also ranked as the highest area for improvement in the overall wishes.

The subjects were more ambiguous about the sending features of their camera phones. Only 9 subjects mentioned sending pictures from a camera phone positively, while 12 subjects reported having problems with this feature, ranging over the high cost for sending, difficulties in setting up MMS, the time it takes to send images, an inability to reach others because they lack devices that could receive images or lack knowledge that they could reply to MMS or email. These findings were affirmed by the responses to the supplemental questions: 13 out of the 23 subjects said they would send more images but they did not know enough people who could receive the images. Also, 8 were inhibited by the cost and 7 said that the quality of the images was not adequate.

The subjects' wishes concerning printing were also somewhat ambiguous. It ranked third on the list of per-image wishes (65 images), usually stated with the qualifier "if the quality of the image was better". From the supplemental questions, the only frequent reason for not printing more images (14 of 23 responses) was that the image quality or size was not good enough. What is still not clear is whether the somewhat low overall interest in improved sending and printing facilities is due to subjects being inured to the foregoing barriers to use, or to lack of intrinsic interest.

Finally, some of the data collected tends to point beyond what is currently available to camera phone users. One of the most prominent per-image wishes (91 images) and overall wishes is the ability to automatically capture data about the context of image capture, such as the identity of those present or depicted, the location, or the ambient

sound. Other desired features included recording videos rather than still images (a facility which most subjects did not have), and the ability to manipulate or archive images in various ways.

DISCUSSION

The results of this study have found that camera phones support a range of activities in a wide variety of contexts: some social and some personal; some with emotional aspects and others of a purely practical nature. In these various capacities, this study sketches a picture of camera phone use which is more complex and diverse than previous data might suggest.

Nature of Sharing

Consistent with recent media reports, there was little evidence of a strong "capture and send" culture for the camera phone users we studied. Overall, while capture rates were about 8 per week, sending rates were considerably lower than this, a fact confirmed by the finding that less than 8% of the images our subjects had on their phones had been sent to them by other people.

Despite this, because we collected quite detailed data, we were able to show that the camera phone was in fact used with some kind of sharing in mind for two thirds of the images we examined, and mainly for affective reasons rather than functional. Subjects were very aware of opportunities for sharing their images and found a variety of ways of doing so. In fact, the majority of image-sharing took place face-to-face on the phone itself. This was often done "in the moment" with others, but also was frequently done after the fact in social situations. The kind of sharing described to us was both casual and spontaneous in that sometimes it meant passing the phone to someone else, or swapping phones with a friend. As one youth put it:

"a few of my friends might have seen this [image] when looking through my pictures generally … They scroll through all the pictures I have or if there's a particular meaning behind one of them then I'll show them that directly… ...and they (reciprocate by handing their own phones for me to look at) .. It's much cheaper and less confusing than having to (send images to) people."

Thus, the camera phone users in our study did use the camera phone very much as a way of enhancing social interaction, although not necessarily in the way that most mobile phone operators had perhaps initially envisioned. Key to the value of the camera phone in these situations was the immediate display of photos for sharing face to face, although, unlike a digital camera, the fact that it is also a mobile phone means that the "always to hand" nature of the device allowed for much more ad hoc capture as well as ad hoc sharing in social settings. Indeed, being always to hand was mentioned as the main thing that the subjects in our study liked about their camera phones.

Barriers to Sending

The sending of images did of course occur (via MMS and, to a lesser extent, through email, infrared or Bluetooth connections), even though this was not the main

mechanism through which sharing was achieved (overall about a third of all examined images were shown on the phone and only about one fifth were sent from the phone.)

The data suggest a number of reasons why sending was not more frequent. As the quote earlier illustrates, expense and complexity both arose as barriers to sending. The poor quality of the image was also frequently mentioned as a reason why images were not sent.

In addition, the lack of enough people to send images to was also a significant barrier. As one camera phone owner put it: "I'm surprised at how few of my friends have one." Furthermore, even if friends and family had phones capable of displaying images, it was not possible for them to receive and view them on the phone if they did not subscribe to a compatible MMS service.

The subjects in our study said they knew on average about 8 people who had camera phones. However, when we asked them to state how many people they sent images to, the overall result was much lower: 2.5 people on average. The subjects reported that they received images from even fewer people: 1.9 on average. All this suggests that when considering barriers to sending, in addition to the need for a "critical mass" of people to send images to, in fact a constellation of factors is at work including cost and complexity.

New Forms of Interaction
To represent camera phones primarily as "capture and show" rather than "capture and send" devices, however, would be to misrepresent the range of activities they were seen to support and the evidence of interesting and new genres of activity emerging. The categories of use we have reported also suggest that camera phones are not simply extensions of already existing devices (such as mobile phones or digital cameras), but rather enablers of new forms of interaction. These, in turn, are related to the particular affordances of these devices.

Communicating with Images
To be more specific, the ability to bring remote friends and family into a visual experience and the achievement of tasks with remote people through the use of images, are supported by the particular combination of camera with direct sending capabilities. While we have noted a number of barriers to use in this respect, when such activities were achieved, they were compelling examples of new forms of communication.

These activities are distinct in several ways from related activities such as the sending of text messages, or the emailing of digital photographs. For example, unlike text messaging, many of the images sent to absent friends and family were in fact visual evidence or proof of something having had occurred. Many such messages were sent with no need for further explanation; they made sense because of shared context and understanding. In this sense, like text messages, they depended on and symbolized the closeness of a relationship. Such cryptic images (to the outside observer) include many playful images, visual riddles and shared jokes. Unlike emailed images, the fact that they could be captured and shared almost in the

moment added an extra dimension to this kind of remote sharing. Proof of being somewhere or experiencing some event could be made more potent by showing *when* something was happening as well as *what* was happening.

Task-related visual messages, too, provided examples of new ways to communicate for practical purposes. Here we saw the spontaneous capture of visual information which would help someone else achieve a task (such as showing what the fabric for a jacket looks like). In cases where the information is fundamentally visual in nature, neither text nor voice will suffice. Such information can be emailed or sent in other ways, but the spontaneity of capture allows the technology to take advantage of opportunities in a much more ad hoc way. In addition, sending information from phone to phone rather than PC to PC not only allows someone to discharge their responsibility for a task in the moment, but does so in a way that connects directly with a person regardless of their location. In the case of the father sending the reminder about feeding the fish, the father was deliberately choosing a device that the daughter would have on her person, rather than something she would see only when sitting at her PC.

Always to Hand
In addition to the particular activities afforded by the ability to capture and send, other more subtle aspects of the camera phone meant that its use was fundamentally different from, say, digital or conventional cameras. Specifically, the "always to hand" property of camera phones combined with the ability to view images directly and immediately after capture supported new kinds of personal as well as social forms of interaction.

Because camera phones were always to hand, the ability to capture anywhere and view anywhere meant that camera phones were often used as personal "flipbooks" of images. Here, the fact that they could be kept close was important for reflecting and reminiscing. In a way, this augmented what we already know about mobile phones in general – that many people feel a strong emotional attachment to their phones [16]. It is therefore perhaps not surprising that the camera phone was used as a device for keeping close and viewing images with which one feels a strong emotional attachment. In fact, this was our single biggest category of the six that we outlined in the taxonomy.

Capturing and viewing anywhere, as it turned out, also supported more task-related personal functions. While not as frequent, the ability to capture and carry images to be used in some future task took many forms. This included capturing evidence of an event having occurred, capturing images of physical objects or documents related to an event, and capturing images as personal reminders to do something in the future. In a study where people were asked to carry digital cameras with them wherever they went [16], similar findings about task-related images were reported.

The "always to hand" nature of camera phones also supported a range of interesting sharing behaviours on which we have already commented. This includes

capturing and showing in the moment, and capturing and showing after the fact. This gave rise to similar activities that one sees with digital cameras, such as storytelling using the back of the camera.

However, the persistent availability of camera phones led to some distinctive choices of image locations and subject. On the one hand, many of the images we observed were of the kinds of subjects people typically take – those of family and friends, for example. Equally, many images were taken in the kinds of places people often have cameras with them -- the home, weddings, planned trips etc. On the other hand, the camera phone was used almost as much in places where people typically do not have cameras – work/school, social venues such as pubs and restaurants, and when "out and about". Moreover, there was a sub-genre of images depicting unconventional subjects, which were taken spontaneously for reasons such as amusement, experimentation or curiosity. Those less conventional images do not necessarily have lasting value, but the effort required to take them is negligible and so a whim may be fulfilled or a passing moment captured. As one subject said about an image taken when playing with her partner's son: "It was perfect at the time … rather than running around trying to find the digital camera."

IMPLICATIONS
So what does all of this mean for the future of camera phone technology? We can expect image quality, which was an issue for many uses, to continue to improve as a matter of course. But this research suggests that deeper changes to the design of the device and its services are needed.

The first and perhaps most obvious point is the recognition of the diversity of activity that camera phones support in terms of functional as well as affective activities, and individual as well as social activities. In other words, their use is much more complex and richer than any simple model of camera phone use would assume. Therefore, without a clear understanding of the range of use, one cannot begin to exploit and support those activities, let alone recognize the potential need to move between them. For example, designers of camera phone technologies need to be aware of how requirements for image quality and support for printing and archiving vary according to the activity.

A second important finding was the recognition that capturing and sending has the first glimmerings of a new and compelling genre of communication which, at this point, is fraught with problems. There are obvious implications to deal with barriers to use including the elimination of technical complexity, lowering cost, and improving image quality. Unless and until this happens, it may be some time before a critical mass of users sees picture messaging traffic increase.

Until such time, however, the findings have pointed to the many other ways in which camera phones are used, each of which is worth considering as a valuable activity in its own right. For example:

- *Easier Showing in the Moment.* One of the key values of camera phones that we have seen has to do with the quick and easy way images can be shared in the moment. This combined with the swapping of phones reported in social situations suggests that browsing photos needs to be as simple and straightforward as possible and should be emphasized as a key way of sharing. The quality and size of the screen is also important, although their trade-off against cost and portability is problematic suggesting that connecting with in situ displays may offer interesting alternative solutions. For example, the iPod photo [14] is designed to support rapid browsing and searching through large numbers of images, and to enable viewing them on a TV. It remains to be seen how best to implement those features. Pervasive computing research includes a variety of approaches to interacting wirelessly with environmental displays, including the use of symbols recognized by camera phone [13].

- *Easier Giving in the Moment.* Our subjects frequently said they wanted to give images to those who were present at an event. However, they often failed to follow through with these intentions. The data suggest that the impulse to share is greatest at the time of capture, but is largely not capitalized on. It may be that if sending in the moment were made easier, then this would happen more often. This suggests not only that the ability to beam to single recipients be as simple as possible, but also that one might also want to broadcast the same image to a number of people in the same space, for example if one is at a party or even a work meeting.

- *Better Tools for Personalisation.* When images were given after the fact, however, many of them had the quality of digital gifts or greeting cards for friends and family. In some cases, considerable effort was sometimes put into these images to personalize them. For example, one subject took considerable pains to take a picture of a bunch of flowers, print it out, and send it to someone with a thank you note. Our subjects expressed a desire for better ways of annotating and editing their images, printing them and incorporating them into other kinds of documents.

- *Better Ability to Connect in the Moment.* Our examples of the interweaving of images into larger conversational contexts (whether by email, telephone or even IM) suggest that there may be the opportunity for interesting applications which allow, for example, ongoing talking or messaging while viewing images (individually or jointly). As it currently stands, the people in our studies had to use multiple devices to accomplish this activity. This suggests camera phone users might value the ability to keep a voice or text-

based conversational channel open while capturing and exchanging images in parallel, all on the camera phone itself.

- *Better Tools for Mementos and Records.* We have seen that camera phone images can be effective mementos and records, both personal and shared. But even the best images capture only some aspects of a situation, and other aspects may escape later recall or remain hidden to people who were absent. Our subjects responded positively to the idea that a camera phone could automatically capture more information about the context and link it to the image. Using pervasive computing technologies, in principle it would be possible to record who was present (in and out of the image), where the image was captured, the sound, and even incidental parts of the context such as the weather. Services could then, for example, make this "hidden" context available during later viewing.

- *Better Tools for Archiving.* The desire to keep images long term was often mentioned, particularly those taken as personal mementos or as gifts for others. This points to the need for quicker and easier tools to help people sift through and archive camera phone images, in potentially large numbers.

- *Better Support for Task Management.* Many of the images that people took for practical purposes were in fact only for short term purposes. Further, there were significant numbers of task-related images warranting the consideration of services and/or features that support these activities. For many such uses, neither quality of the image nor long term storage were significant issues. For example, it was more important that images used as reminders conveyed the reminding at the right point in time, rather than showing an image in detail. This suggests that for some classes of images, features such as the ability to attach alerts or to know that someone has received a task-related image through a quick OK or reply button, for example, might be important.

Finally, this study may have implications for web-based forms of sharing, including "moblogs". The study has shown that many images are taken of spontaneously chosen things and events, and that communication via such images often either relies upon common ground (shared context) between the photographer and a specific audience, or it involves an in-person interpretation of aspects that the audience could not understand unaided. While the web may be suitable as a way of archiving images, and of presenting relatively straightforward images to a broad audience, it is not clear how to adapt it for use in such a personal way.

CONCLUSIONS

The study shows that the camera phone is neither an incremental step forward from a mobile phone, nor a poor relation of a digital camera. Rather, it is a device which is sometimes used rather like a digital camera, but is different in the range of activities it supports. Some of these are made possible because of the ability to not only capture, but also to send. Others are made possible because of the fact that camera phones are always to hand. This "at handedness", as well as its communicational capabilities support primarily affective use of the camera for both personal and shared reasons, but also support a significant amount of use for practical or functional tasks. As an ever-present imager with communicational reach, it also has a great deal of social, personal and functional reach.

This work has shown the use of the camera phone in its many guises, from ever-present "photo wallet" for sharing or reflection, to a means of communicating in the moment with absent friends and family, to its use in task management and the accomplishment of remote and shared tasks. It excels in particular where sharing is fluid and spontaneous, such as showing images in social situations. Despite many barriers to use, the ability to send images for a range of reasons remains compelling. We have attempted in this paper not only to highlight the potential of this new technology, but to point in new directions which will encourage and support the full range of activities that the data suggests.

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