Chapter 6
Digital Photo Adoption

Given the unfolding of the digital photography infrastructure over the last 20 years, as described in Chap. 4, we now turn to its practical use by Western families as described in the research literature. We draw mainly from work in HCI and interaction design, since that provides the most detailed empirical insights on technology mediated practice. Our interest in reviewing this here is in whether and how the traditional values of film photography are changing, and what new social and business practices are emerging to characterise domestic photography. In Chap. 2, we pointed to three primary values of domestic photography, related to memory, identity, and communication (after work by Chalfen and Musello[1]). In Chaps. 3 and 4, we showed how these were played out in differing combinations, salience, and forms in the development of film photography as people learned what could be done with a camera and a photograph, and how it might be archived and shared. In this chapter, we consider whether the same values are still realised through the properties of digital photographs and our interaction with them, or whether the digital revolution has changed the very nature of photography and why we perform it.

We also examine the interplay between technology, business, and practice factors as this changes with the introduction of each new element of the digital photography infrastructure. This broadly follows the timeline shown in Fig. 5.1, in the previous chapter. Because of the lack of early papers on the use of individual products such as digital scanners, cameras, and photo printers, we begin with an examination of what we call the home photo lab, before moving on to cover the home archive, the camera phone, online photo sharing, offline photo sharing, and current photo ecologies.

[1]Chalfen 1987; Musello 1979.

R. Sarvas and D.M. Frohlich, *From Snapshots to Social Media - The Changing Picture of Domestic Photography*, Computer Supported Cooperative Work,
DOI 10.1007/978-0-85729-247-6_6,

6.1 The Home Photo Lab

The first studies of digital photo adoption in the home began to be published after the millennium year, 2000. This was at least 10 years after the introduction of the first digital camera to the consumer market, in 1990, indicating the typical time lag between the release of a new technology and empirical studies of its adoption. Prior to that time, there was growing speculation in the media studies area about the possible impact of digital imaging on visual culture in general. This was captured most succinctly in a collection of essays by British scholars on the photographic image that was edited by Lister 1995,[2] including one by Don Slater on domestic photography and digital culture.[3] We begin with this essay as a preface to the first three empirical studies of digital photo adoption, as it sets the scene for those studies and raises issues we will return to later in the chapter.

Slater argues that domestic photography has always been bound up with family narratives and identity, as well as with home entertainment and leisure. Somewhat paradoxically, photography equipment and snapshots are forms of consumer goods enjoyed in leisure time, which is itself the main subject of images depicting family life. Snapshots typically capture the family at play rather than at work, and domestic photography is something done in 'play time', either on holiday or at family gatherings and rituals. This situation is sometimes illustrated graphically by snapshots showing a snapshooter at work. Digitisation of photographs, according to Slater, did not appear to threaten these kinds of capture activities, but it did appear to interact with related forms of visual, sound, and textual media being introduced into the home through cable TV, digital games, and multimedia computing in general. In 1995, this appeared to Slater to create opportunities for combination of private still images with other media and with public images of other kinds:

> However, as already noted, looked at from the present moment, and without engaging in ungrounded prediction, it is not at all clear that domestic photography – in the sense of snapshooting – has been transformed in the slightest by digital technology. What certainly has been transformed is the domestic context in which snapshots exist, a transformation in the domestic economy of images: digital technologies patently involve a major extension in the volume and complexity of flow of public images through domestic time and space.[4]

On the basis of other trends in domestic image consumption, Slater then speculates about the potential of digital images to liberate family members from their idealised representation in the family album, and empower them to tell their own stories in the moment:

1. The pinboard or 'photographic wall' may become a more dominant metaphor for domestic photography than the family album. This builds on the practice of creatively assembling photos of the moment as "*acts of* practical communication rather than reflective representation".[5]

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[2]Lister 1995.

[3]Slater 1995.

[4]*Ibid.*, p. 131.

[5]*Ibid.*, p. 139.

2. Individual family members may use digital photos to tell their own stories to themselves and to others.
3. Practice in self-presentation and representation through images may demystify portrayals in public media and call into question their realism.
4. Self-produced representations may challenge the dominant media, act as instruments of local democracy, and become "part of the rebirth of civil society in which our private cultures have real public meaning".[6]

As we shall see, these issues turned out to be remarkably pertinent, especially as subsequent waves of (Internet) technology unfolded to support the wider flow of snapshots into and out of the home. However, this was not immediately apparent from the first empirical studies of domestic digital photography, which focused very much on the home photo system and the parallel use of analogue and digital photographs.

The first three studies published on home digital photography originated in the corporate research labs of Hewlett-Packard and AT&T, both giants in their respective fields: personal computing and telecommunications. Competing photo management systems were under development in both labs, FotoFile at HP[7] and Shoebox at AT&T,[8] together with related lightweight communication tools dating back to the early 1990s (e.g., Deskslate,[9] Montage,[10] Voicefax,[11] Telenotes,[12] and informal video[13]). Following the development of FotoFile at Palo Alto Labs in 1997, the technical team partnered with the second author (Frohlich) at HP Labs Bristol to conduct a more basic study of photo organisation and sharing in 1998.[14] This was carried out with 11 digital-camera-owning families in Northern California. AT&T researchers independently conducted a field trial of Shoebox in the spring and summer of 2000 with 13 individual staff from their Cambridge, UK, labs.[15] A second AT&T team, based on the west coast of the United States, replicated aspects of the HP study with 10 teenagers from high schools in northern California.[16] This supported their parallel investigation and development of instant messaging technology.[17]

Early preoccupations then were with the issues of archiving, retrieving, and *printing* digital photographs from home collections, and with sharing them over the Internet. Contrasts with 'legacy' practices based on photographic prints were

[6] *Ibid.*, p. 145.

[7] Kuchinsky et al. 1999.

[8] Mills et al. 2000.

[9] O'Conaill et al. 1994

[10] Tang et al. 1994.

[11] Frohlich and Daly-Jones 1995.

[12] Whittaker et al. 1997.

[13] Isaacs et al. 1997.

[14] Frohlich et al. 2002.

[15] Rodden and Wood 2003.

[16] Schiano et al. 2002.

[17] Isaacs et al. 2002a, b.

inevitable since all participants in these studies were users of existing prints and film cameras. The default assumption of most of the computing industry at that time was of digital photography replacing film photography through a 'digital whiteroom' or 'home photo lab', in which families could capture, edit, print, and store their own photographs at home without recourse to external photo-processing or storage services. This was especially true of HP, who were a leading manufacturer of home printers as well as home computers. A competing view was adopted by Kodak, who aimed to digitise their photo-processing services and make them the preferred outlet for printing all home photographs, of both analogue and digital origin. Unfortunately, this print-centric vision of digital photography never was realised and was challenged immediately by findings from each of the above-mentioned studies.

Frohlich et al. (2002) re-purposed Johansen's (1988) groupware framework[18] to step through the use of four forms of 'photoware', or groupware for photographs (see Fig. 6.1). These activities included co-present sharing of images, remote sharing, archiving, and sending. Insights into each activity came from in-depth family interviews conducted in homes, as well as analysis of diaries and recorded conversations related to photo sharing episodes taking place over 3 months after

	SAME TIME	**DIFFERENT TIME**
SAME PLACE	Prints Slides & projector **CO-PRESENT SHARING** *Photo viewing software & devices*	Shoeboxes Albums & frames **ARCHIVING** *CD-ROM* *PC filestore* *Photo website*
DIFFERENT PLACE	Telephone **REMOTE SHARING** *Application sharing* *Instant messaging* *Video conferencing*	Mail **SENDING** *Email attachment or website reference* *Internet photo frames*

Fig. 6.1 Dimensions of photoware (Reproduced from Table 1 in Frohlich et al. 2002. Original title: Dimensions of photoware. Republished with permission)

[18] Johansen 1988.

the visits. Digital photographs had not replaced analogue photographs as the primary record of family life, but they had supplemented them as a means of easy transmission to family and friends. Face-to-face sharing was still done largely through printed photographs, because of the difficulty of sharing on fixed desktop computer screens, and *selected* digital photographs were printed for sharing and incorporation into traditional print albums and frames. Parallel archives of print and digital photographs were kept by families in roughly the same state of disarray, although families believed that their digital photographs would be easier to find and manage in the future. The difficulty of remote photo-conferencing was identified as an opportunity for new technology, as was the creation of contextualised mini-albums (stories) and community photo Web sites for sharing. Perhaps more important than the individual findings and recommendations was the call to support *photo-ware* for family and friendship groups. This term eventually came to mark an identifiable shift in domestic photography with digitisation, away from a focus on memory, toward a focus on communication.

Similar findings were reported by Schiano et al. (2002) in a brief poster write-up of the teen study. Printed photos still dominated accounts of face-to-face photo sharing and display, even though some participants reported early experimentation with PC, TV, and camera LCD screens for this purpose. Fewer digital photos seemed to be printed by teens as compared to families in the Frohlich et al. study, leading to divergence of print and digital collections and more extensive online posting and sending of digital snapshots by teens. The authors also recommended better photoware for supporting the "social/conversational aspects of photo viewing and sharing", and easier methods for annotation, browsing, and retrieval of digital images from a collection.

The Rodden and Wood (2003) study effectively tested three examples of the latter methods, including thumbnail browsing, audio annotation/transcription, and content-based retrieval. Participants were given digital cameras for a 6-month period and copies of the Shoebox application in which to store their digital images on a family computer. Analogue and digital photo management practices were compared. As in the two previous studies, participants all attempted to create printed photograph albums from film-based snapshots, with mixed success, falling behind with the task for more recent photographs but enjoying the result and aspiring to keep up. In contrast, they rarely attempted to make digital photo albums inside or outside Shoebox, and they limited their manual photo organisation activities to making time or event-based folders (known as 'rolls' in Shoebox) in which to keep their photo sets. Annotation of individual photographs was deemed unnecessary and time-consuming, so users tended to browse the collection manually, using thumbnails and folders arranged chronologically. This preference persisted despite the possibility of recording annotations in speech and having them automatically transcribed to text (with some errors). Some participants were too self-conscious to record their own voice, while others felt that the transcription was too inaccurate. In general, all participants took many more digital than analogue photographs, because of the lack of cost penalties, and prioritised the immediate sharing of images over organising and archiving them.

6.2 The Home Archive

Although printing turned out to be a less important component of the home photo lab than expected, storage emerged as central. Freed from the constraints of having to pay for each photograph taken, families began to use the digital camera in a more professional way, 'bracketing' events with greater coverage by photographs and taking multiple images of the same thing to achieve the perfect shot. Coupled with the proliferation of cameras themselves, this led to an exponential rise in image capture, with the associated need for high-capacity storage and retrieval. This need was anticipated by the industry in the late 1990s, as indicated by the photo management systems mentioned above. However, consumers were slower to recognise it, as shown in the Frohlich et al. (2002) study, where they displayed misplaced faith in the power of digital technology to help them organise their images. In an internal presentation to HP from this work, we predicted a serious consumer storage problem in about 5 years' time from 2001. This problem manifested itself in a number of ways and became the subject of a new round of studies, aimed at understanding and addressing it.

Hence, in 2006, Microsoft Research published a new study of home photo organisation and retrieval, picking apart the various elements involved.[19] These included selecting, discarding, editing, filing, backing up, and assembling photographs in a cycle of activities following capture but before sharing. These are illustrated in a framework reproduced in Fig. 6.2. Activities are referred to as 'photowork', to distinguish them from various forms of 'phototalk' as described by Frohlich et al. (2002). Insights on photowork were derived from in-depth home interviews with 12 digital camera users who had more than 1,000 digital photos in their collection. Findings covered each stage in Fig. 6.2 and showed the diversity of reasons and contexts for reviewing images and manipulating them in various ways. Typically, participants would review images and delete bad pictures from the camera before downloading them in a batch to a home computer. These would be filed with minimal effort in default folders, which were occasionally duplicated or supplemented with others. Half of the group also worked on the images at this point to modify their composition or correct red-eye effects. Apart from occasional backup activity, the next context for photowork was as a prelude to sharing. This involved correcting and selecting the best images and assembling a mini-collection to print or share. Although selected images were still printed for incorporation in albums or home displays, and to give to others, participants did not generally create digital photo albums or slide shows. That most of these activities were performed for recently captured images indicated that participants did not often search for specific target images across the whole collection. They did not therefore report a problem with retrieving and managing images, despite the growing size of their collections and counter to the prediction above.

[19] Kirk et al. 2006.

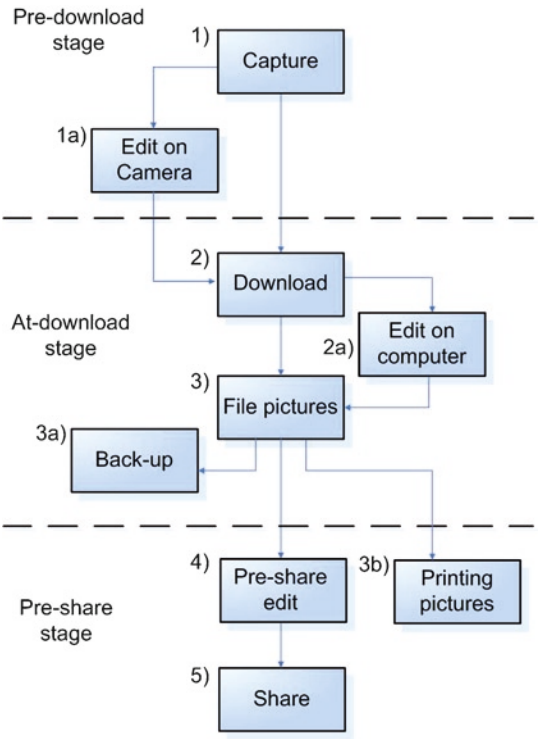

Fig. 6.2 The photowork life cycle (Reproduced from Fig. 2 in Kirk et al. 2006. Original title: The photowork lifecycle. Republished with permission)

These findings are challenged by a more recent study of photo retrieval, using a different methodology. Eighteen parents of young families using digital cameras and home computers were interviewed at home about their photo management practices.[20] In the first part of the interview, they were asked to name significant family events from more than a year ago that they had photographed digitally. In the second part, they were asked to find a photograph from between three and five of these events before discussing the retrieval experience. Participants were surprised to discover that they could find only 61% of the target images. The reasons for this included having too many pictures to search through; having distributed storage of images across different folders, directories, computers, hard drives, and storage media; using minimal hierarchical organisation of folders; and doing minimal revision and maintenance of the photo collection over time.

The average size of participants' photo collections in this study was 4,475 digital pictures, and, as in previous studies, very few of these were organised into digital photo albums. This means that people were effectively searching through 'loose' photographs organised in digital 'packets' likely to contain many more than the

[20]Whittaker et al. 2010.

traditional 36 prints from a roll of film. While this appeared to be sufficient for finding photos less than a year old in the study by Kirk et al., it was not enough for finding older photographs in the study conducted 4 years later on significantly larger photo collections. There is no single solution to this problem, but Whittaker et al. suggest a range of measures to address it, including retrieval by event, manual rating and automatic content analysis of images, and better use of metadata for indexing and presentation.

A final series of studies in this area begins to turn this work on its head and reveal an *advantage* to losing one's way in very large media collections, for both private and social reminiscing. In the first of these studies, findings on organising and navigating photo and music collections were compared.[21] The researchers from Motorola Labs found themselves conducting similar studies of photo and music use in the winters of 2002–2003 and 2004–2005 respectively. In the photo study, six participants were interviewed at work about their photo storage and sharing behaviours. In the music study, 13 participants were interviewed at home about their music consumption habits and asked to select music for different scenarios. Various inefficiencies in their search and organisation strategies across media were reported and linked to positive user experiences. For example, participants rarely looked for one specific item in their collections. Instead, they looked for a certain kind of thing and selected the first one that matched adequately. This behaviour is called 'satisficing' and often results in a surprise selection that is 'good enough' for current purposes. Skipping through unwanted tracks from a random music shuffle is an extreme example of this for music, but similar behaviour was observed with photographs, where folders were opened speculatively with a view to finding something 'interesting'. Such interest could be piqued by the automatic presentation of photos by a computer screensaver. Participants also reported frequent occasions of side-tracking, where they started out looking for one kind of thing and ended up selecting another. This was especially likely when they came across old media that hadn't been seen or heard for a long time, such as pictures of a child now several years older. These experiences often led to enjoyable excursions into forgotten territories of a music or photo collection. Within the constraints of the interviews, participants were sometimes observed to have these experiences and launch into spontaneous storytelling to the researchers, from either medium.

Further findings on the serendipitous discovery of old and new music from random shuffle have been reported by Leong and colleagues in Australia.[22] Interestingly, this effect is enhanced by the size of the music collection over which the shuffle operates. Back in the photographic domain, Hilliges and Kirk have tried to support serendipity over an entire photo collection, using a novel photo visualisation and control interface to a tabletop display.[23] The interface, called *PhotoHelix*, allows users to spread out multiple images for an event from a spiral-shaped calendar on the display, using a cylindrical control knob placed anywhere on the display surface. They show how it can lead to surprises and side-tracking in photo-talk

[21] Bentley et al. 2006.

[22] Leong et al. 2005; Leong et al. 2008.

[23] Hilliges and Kirk 2009.

between pairs of people, reviewing material together on the display. The same sort of side-tracking has been observed in more naturalistic interactions around printed photographs or those displayed on a shared computer screen.[24] Typically they occur in what Frohlich et al. (2011) call 'collaborative photowork', where photos are discovered and discussed among members of the family whilst being sorted or prepared for sharing.

While many of these practices apply to printed photo archives, others are specific to digital ones, which are easier to duplicate, edit, and distribute between devices and people. From the perspective of ordinary families, the full photo archive consists of a mixture of printed and digital photographs with interesting connections to other home media such as music, books, and video. The exponential increase in digital photo capture does not seem to have affected short-term photo storage and retrieval but is leading to a paradoxical mixture of frustration and delight in longer-term use as families forget what photographs they have taken and where they have put them, only to find them again via accidental browsing and discovery.

6.3 Camera Phone Use

Around the time Frohlich and colleagues were examining digital camera use by UK and US families (in 1998), a group of European researchers were examining the combined use of digital cameras and mobile phones by four Finnish boys and an Austrian family of seven.[25] This work pre-dated the launch of the first camera phones by Sharp in 2001 and Nokia in 2002 (discussed in Chap. 5) and consequently involved a different methodology. Instead of monitoring the uptake of commercial technology, the team ran a field trial of a prototype camera phone. This took the form of a large digital camera tethered to a laptop in a backpack, with software and hardware supporting image editing, combination, and transmission to similar prototype devices via GSM. The study was part of a European Union project called *Maypole*, investigating the future of family communications between 1997 and 1999. Nokia was a partner in the project, as were IDEO, Meru Research, the Centre for Usability Research and Engineering in Austria, and the Netherlands Design Institute. An overview of findings was reported in a special issue of *Interactions Magazine* at the end of 1999, in which there was a palpable sense of excitement.[26] Seppo Kari from Nokia was quoted in an interview as referring to wireless imaging as the next step in mobile telephony, involving a shift in emphasis 'from ears to eyes'.[27] Describing the camera phone trial, Kay Hofmeester, the project manager of Maypole, said this: "It worked! The results we saw gave us the feeling that we had stumbled on a phenomenon that was much broader and more interesting than we had dared expect".[28]

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[24] Frohlich et al. 2011.

[25] Mäkelä et al. 2000.

[26] Hofmeester 1999.

[27] Seppo Kari quoted in Staal 1999, p. 65.

[28] Hofmeester *Ibid*., p. 10.

They were right. From a photographic point of view, the addition of mobile communication to a digital camera gave consumers the opportunity to share images and experiences remotely in real time – speeding up the sharing process, which was already becoming the driver for digital photography in the home. From a mobile communication point of view, the addition of a digital camera allowed consumers to illustrate their conversations or messages with images – extending the communicative flexibility of the phone. Both values and behaviours were evident in the field trial. Unlike traditional snapshots of special occasions and holidays, trial participants took photographs of everyday life and sent them to each other to establish more frequent connections over the course of each day. Many images were deliberately playful and often combined together in sequences to form photo narratives. For example, the 12-year-old boys created visual jokes or fictitious movie scenes such as a murder. They also sent around pictures of their pets or girls they had seen. One boy even took screenshots of a computer game to help describe it to his friends. The parents in the Austrian family had less time and inclination to communicate like this but appreciated being sent images showing what their children or distant parents were doing. One parent, a grandmother of the children, had more time and crafted artistic images of her garden and life to share with her grandchildren. Most participants complained about the lack of text or sound-recording by which to explain the images to recipients, and this was recommended by the researchers as a design suggestion. Many of the prototype features were endorsed among these recommendations, including a review screen for local sharing, image editing facilities, multi-photo messages, and printing.

Many of the recommendations were taken up immediately in two follow-up studies by Ilpo Koskinen and colleagues at the University of Art and Design Helsinki. These were supported by Nokia again and Radiolinja, Finland's main mobile phone operator at the time. The first study, titled 'Mobile Image', conducted with 20 participants in 1999–2000, was a field trial of another prototype camera phone, in the form of a Casio digital camera and a Nokia Communicator 9110 mobile phone with infrared connection.[29] Software on the phone allowed images to be attached to e-mail messages sent to other phones by GPRS. The second study, Radiolinja MMS, conducted with 25 participants in 2002, was a field trial of the Nokia 7650 mobile phone with integrated multimedia messaging (MMS) incorporating pictures, sound, and text.[30] Hence these studies extended the original Maypole work by looking at the combination of photographs with text and sound, as used by a larger number of young adults.

In the Mobile Image study, participants exhibited the same kind of playful use of photographs as in the Maypole study to maintain social connections within groups of five friends. Humour and fun were intrinsic to many of the exchanges and involved friends teasing each other with pictures of attractive partners and activities, or staged and manipulated images of fake experiences. More details emerged on the

[29] Koskinen et al. 2002.

[30] Koskinen 2007.

Fig. 6.3 A picture message from Italy, sent in the Mobile Image study. The associated text reads as follows: "Terde, at 1100 metres +25C. Stuffed my face with pizza, birra and grappa" (Koskinen et al. 2002. Original title: A picture message from Italy. Republished with permission)

interactive features of image exchanges, in part because of the conversation-analytic orientation of the analysis. Almost all images were framed by text commentary in the e-mail body. For individual images, this comprised a greeting and sign-off with a brief reason for sending in between. When sent from a holiday destination, these had the character of a postcard, as shown in the message reproduced in Fig. 6.3. More typically, they were sent from everyday places, made to sound exotic. Individual messages were tailored to the interests and knowledge of the recipient, such that the same image received different text annotation for different recipients. Collections of images were often sent together as a photo narrative with interspersed text, or generated across the group in themed responses. 'Theming' was extremely common and involved replying to a photo with a photo concerning a similar topic, such as pictures of current boyfriends circulated in a group of five females.

In the Radiolinja study, the same style of image-based communication was observed but with additional features. Participants introduced third-party contacts, used pictures of hand and body gestures to signal to each other, took photographs of TV programmes to discuss, and circulated riddles and jokes. The capability to add sound to a message led to additional findings on sound–image–text combinations.[31] In general, sound was used much less frequently than text was with an image. Text was almost always used, whereas sound was used in only 13% of the 543 sampled messages. This meant that participants treated sound as an adjunct to an image+text message, which was the usual form. In fact, it appeared to be one particular group in the Radiolinja study who discovered the value of sound together and tended to use it in their photographic exchanges. Typical uses included verbal greetings, imitations of animal and human sounds (such as snoring), recordings of particular ambient sounds such as baby noises, and paralinguistic items (including singing, shouting, and laughing).

[31] Koskinen 2005.

These sounds appeared to add emotional depth to the messages rather than substantial linguistic content, which was left to the text portion. For example, in one multimedia message (Message 5.1) a birthday message in text was attached to a picture of flowers and combined with a badly sung rendition of 'Happy Birthday to You'. Koskinen also argued that ambient background sounds in each of the recordings provided additional cues to the location and context of the sender, which may have been important for the subsequent interaction. These findings were contrasted with those of Frohlich (2004) on audio–photo combinations recorded on audio-capturing cameras.[32] Whereas sound from a camera appeared to support the *memory* associated with an image and its discussion with others, sound on a camera phone appeared to support the *message* created from the image+text and its interpretation by others. This is not surprising, given the prominence of text messaging in MMS creation. The interface of this prototype has been carried forward into modern mobile phones and has involved the addition of secondary image and sound elements to a primary text message.[33] This introduces additional steps in the process of adding sound to an image and privileges text as the primary form.

All these early studies of camera phones were done as field trials of prototypes given out to small groups. As commercial camera phones became more common, a new set of more naturalistic studies was conducted, looking at the capture and sharing of images with off-the-shelf equipment and infrastructure. Two key studies in this category involved interviews with ordinary consumers in Japan, the UK, and the US. Here, Okabe and Ito at Keio University interviewed 15 people in Tokyo during the autumn of 2003.[34] In contrast to the field trial results reported above, Okabe described a much stronger personal use of camera phones for capturing more casual mementoes of everyday life. The images were less stylised than traditional family snapshots and depicted more mundane subjects, such as pets, landscapes, social events, and work scenes. But they were taken with the same intention of remembering intimate personal experiences in the future. These same photographs were often shown to others on the LCD display of the camera phone rather than sent remotely, although sharing was not the original motivation for capture. A new behaviour was visual note-taking for practical purposes, such as taking a photograph of a book to remember to buy it later. Some of the same playful exchanges of messages observed in the camera phone trials were described by Japanese camera-phone-owners. These included pictures of food, unusual objects, and events that were sent in the moment by e-mail or MMS to close family and friends. This appeared to extend a text messaging practice of establishing distributed co-presence by sending (picture) messages telling recipients what one is currently doing.

About 9 months later, in the summer of 2004, Kindberg and colleagues at HP and Microsoft interviewed 19 camera-phone-users in the UK's Bristol and Cambridge,

[32] Frohlich 2004.

[33] Koskinen, 2010, personal communication.

[34] Okabe and Ito 2003.

and 15 others in the San Francisco Bay area of the US.[35] They found similar practices to those seen with the Japanese consumers. In particular, e-mail and MMS sending of images was rare in comparison to sharing locally on the camera phone screen, and half of the images (51%) were taken for personal use. Those taken for social reasons were often to share with people who were with them at the time, as well as with absent family and friends, and there was a general split between photos taken for their affective and their functional value. This led the authors to propose a taxonomy of six reasons for image capture on a camera phone. These are listed below, with their definitions and examples from the paper:

1. **Individual personal reflection**: Affective images used for personal reflection or reminiscing. Example: Picture of a gift received.
2. **Individual personal task**: Functional images used to support some future task not involving sharing. Example: Picture of a car registration number after an accident.
3. **Social mutual experience**: Affective images used to enrich a shared, co-present experience. Example: A celebration in a pub.
4. **Social absent friend or family**: Affective images used to communicate with absent friends or family. Example: Picture of muddy boots at a music festival.
5. **Social mutual task**: Functional images shared with people co-present in support of a task. Example: Picture of a plumbing problem for diagnosis.
6. **Social remote task**: Functional images used to accomplish a task by sharing with remote family, friends, or colleagues. Example: Picture of a goldfish for the recipient to remember to feed.

At the time of this study, nine of the 34 participants were able to record video clips on their camera phones. However, these people took three times as many photos as videos and most activity was related to still image use. Later work reviewing the use of short video clips on camera phones and digital cameras is worth mentioning here in the context of digital photography. As it turns out, short video clips seem to be used like photographs to support some of the six values above, but in far fewer numbers than photographs themselves.

For example, in an attempt to understand *videowork* as well as *photowork*, Kirk and colleagues interviewed 12 families and seven teenagers in the UK to discuss their use of digital video.[36] This broke down into two forms of video use, 'lightweight' and 'heavyweight', based, respectively, on the *ad hoc* capture of short video clips on a camera / camera phone or the more deliberate capture of home video footage on a digital camcorder. Lightweight video use was characterised by spontaneous capture and consumption on the device itself to enhance a shared event (value 3 above) or share with absent family and friends later (value 4). Sometimes the later sharing would be done by uploading the video clips to a Web site, but more often than not it was done locally on the camera or camera phone. A further study of lightweight

[35] Kindberg et al. 2005.

[36] Kirk et al. 2007.

video use was conducted by Lehmuskallio and Sarvas in spring 2007 with 13 Finnish participants.[37] Users were interviewed at home about photo and video use, and seven were given camera phones for an 8-week period in which to capture new photo and video material. By comparing photo and video content and practices in this group, the authors were able to show that brief video clips were effectively used as 'living photographs' rather than as narrative forms of film. They called these clips *snapshot video* and showed how their content was similar to snapshots but captured in situations where sound and movement added to the memory or affective impact of the recording. Snapshot video clips were also stored, shared, and treated as snapshot photos are, leading to recommendations for integrating them with media editing, archiving, and sharing tools – including photo/video Web sites. These findings also gel with those on audio-photographs, which were captured very much in a point-and-shoot mode to enhance the atmosphere of a photograph with sound.[38] Further findings on camera phone use have been collected in the context of online and offline sharing of photos, and these will be mentioned in Sects. 6.4 and 6.5, below.

6.4 Online Photo Sharing

The earliest forms of electronic transmission of digital photos were made possible in the latter half of the 1990s via e-mail attachment and publication on self-made Web sites. These came to be supplemented by multimedia messaging on camera phones and through the use of commercial photo-oriented Web sites around 10 years later (see again Fig. 5.1). The launch of photo Web sites and camera phones on the consumer market at around the same time, in 2000 and 2001, respectively, led to a delayed burst of studies in the mid-2000s on their combined use.

Hence, the first studies of online photo sharing were a pair of independent field trials of prototype camera-Web systems for 'mobile image sharing'. We report on these here since they indicate styles of online photo sharing observed in later studies of commercial photo Web sites. *MobShare* was a Finnish system for adding camera phone images to an organised Web album[39] and sending notifications of these to selected recipients, while *MMM2* was an American system for doing the same thing with some implementation and interface differences.[40]

In general, both systems extended the functionality of the mobile blogging systems available at the time, by prioritising images and adding sharing features for group notification and access. For example, *MobShare* allowed users of the mobile phone part of the system to put newly captured images in folders for sharing. Contacts from the address book could then be associated with folders before sharing was performed by upload of the folder to a Web site and notification of

[37] Lehmuskallio and Sarvas 2008.

[38] See again Frohlich 2004.

[39] Sarvas et al. 2004b.

[40] Davis et al. 2005, and the predecessor MMM1 (Sarvas et al. 2004a).

Fig. 6.4 The process for Internet photo sharing from a mobile phone running MobShare (Figure 1 in Sarvas et al. 2004b). Original title: MobShare screen shots. Republished with permission

contacts of the URL by SMS text message (see Fig. 6.4). Because of the limitations of mobile Web browsing at the time, users were expected to use an Internet-connected PC to browse and view the photos. Discussion of the images was also supported through text annotation of the original photos and subsequent text responses in the Web-based gallery. A similar process was used in *MMM2*, which allowed captioning of individual photos and sharing with a checklist of recipients via a Web site. After every capture, senders were asked whether they wanted to upload images, and recipients were informed of the destination URL by an e-mail message containing a thumbnail of the image.

Both systems were tested locally, in Finland and the US. MobShare was used for 5–6 weeks by five friends who were familiar with e-mail, Web browsing, and SMS but had not owned a camera phone before.[41] Each participant recorded an average of 24 photos a week (589 in total for everyone) and shared 89% of these with each other or any of 48 additional users in their contact lists. Most pictures (84%) were shared within 3 days of capture and commented on within 6 days of posting to the Web site (95%). This reflects the importance, found in other studies, of **recent** image sharing but shows that sharing was not always done immediately, even from camera phones equipped for this. In general, the sooner recipients visited a gallery after posting, the more likely they were to leave a comment. Discussion of photographs ranged from responses to initial comments and questions, personal perspectives on a shared event, observations on an unfolding drama (such as the birth of a dog), and thanks for a photo or social event.

[41] Sarvas et al. 2005.

MMM2 was used by 40 students and 20 staff at the University of California at Berkeley.[42] It was installed on Nokia 7610 camera phones that were in service for 5–9 months, from November 2004.[43] Analysis of student data from the first 6 weeks of the trial showed that participants shared 1,500 photos, at an average rate of one per day.[42] Interestingly, these photos made up only 57% of the total number of pictures taken by participants – a figure that rose to 75% with the introduction of an algorithm to recommend (guess at) recipients for sharing. Both figures are substantially lower than those in the *MobShare* trial, and they indicate that the US participants were taking more personal photographs on their camera phones or sharing them in other ways. This accords with Kindberg et al.'s (2005) survey of camera phone users in the US and UK, in which 51% of photographs were taken for personal use and many were shared face-to-face on the display of the camera itself. As in the Kindberg et al. study, Van House and colleagues examined the content of camera phone images with participants, but this time it was to infer the reason for sharing. They found the same range of uses for sharing as for capture, as shown in Kindberg et al.'s taxonomy, given in Sect. 6.3. However, to these they added self-expression and self-presentation, referring to the sharing of artistic images and self-portraits, respectively. This pointer to the sharing of images related to **identity** turned out to highlight a key behaviour observed on some commercial photo Web sites and social networking sites.

The first commercial photo Web sites, such as Snapfish and Kodak Gallery, were launched in the early 2000s and designed as online archives for family photographs. In fact, there was a debate in the industry at this time about whether families would move all their digital photographs from the home PC to the Web for long-term storage, whom they would trust to look after the images, and how much they would pay. Consequently, the facilities provided by these Web sites were more primitive than those of MobShare and MMM2, and simply allowed collections of images to be assembled in folders or albums for joint viewing by family and friends. Internet connection speeds tended to limit the sizes of images that could be conveniently uploaded to and downloaded from the Web, and also the effectiveness of additional features such as slide-show creation and sharing. This may also have been a factor contributing to families' tendency not to move their photo collections to the Web, although a bigger factor is likely to have been the volatility of Web companies and photo Web site services, which sometimes went out of business and could not be trusted with priceless memorabilia. These companies struggled to make money from hosting photographs and still rely on income from advertising and online printing services, which compete with offline print shops, public kiosks, and home printers. Nevertheless, they continue to be used by large numbers of people for simple online photo sharing and exchange. Along with e-mail photo attachment, simple posting to a gallery Web site from a computer may account for the majority of online photo exchange in the world today. This was indirectly confirmed in a

[42] Van House et al. 2005.

[43] Van House and Ames 2010 (unpublished work).

small-scale study by Miller and Edwards of online photo sharing, featuring Flickr as an example of a new class of social networking Web site.[44]

Flickr is essentially a gallery of sorts but supports the tagging of photos and photo elements with multiple keywords and phrases. This means that users can express who is in their photos and what the photo content is, and use these tags to browse through their own and other people's photo collections in a more flexible way than fixed folders and albums allow. They can also make comments on photographs, leading to threaded discussions and blogs on photo content. This functionality brings more of the social interaction that traditionally took place verbally around printed photos into the online domain and fixes it there as a record of interaction for others to see and add to over time. An example screenshot from a typical Flickr page is shown in Fig. 6.5 for reference.

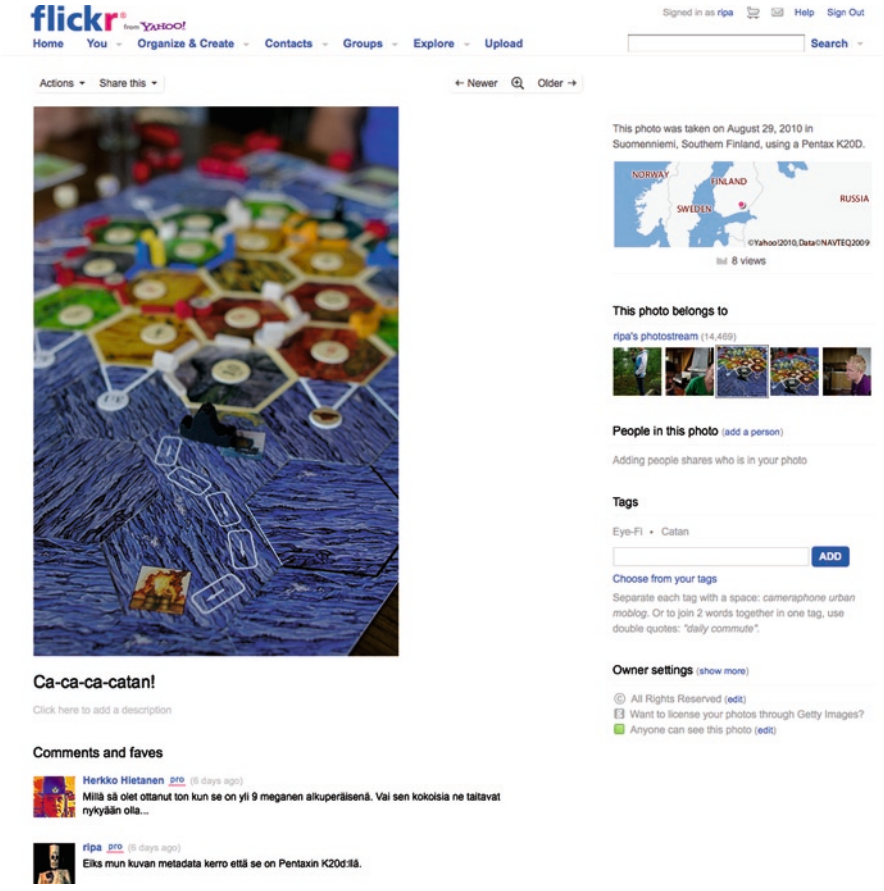

Fig. 6.5 A screenshot from a Flickr photo collection (Reproduced with permission of Yahoo! Inc. © 2010 Yahoo! Inc. YAHOO!, the YAHOO! logo, FLICKR and the FLICKR logo are registered trademarks of Yahoo! Inc.)

[44] Miller and Edwards 2007.

In the US study by Miller and Edwards, 10 people from Atlanta, Georgia, aged between 30 and 50, were interviewed in 2006 about their digital photo practices. Five participants were recruited from a Flickr group and reported photo sharing behaviours quite different from others'. The rest exhibited classic 'Kodak Culture' behaviour and shared digital photographs with family and friends primarily by e-mail but also by means of prints and a variety of photo Web sites, depending on their costs and benefits. Those recruited through Flickr were referred to as 'Snaprs' and shared digital photos with strangers as well as family and friends, primarily through Flickr and its tagging mechanisms. This group shared an interest in the artistic properties of photographs and appeared to use Flickr as a kind of online camera club for viewing and discussing photographs, some of which were taken on 'photo-strolls' with local Flickr users. The photographs in this case were used to reflect the photographic abilities of authors and reinforce their identities as amateur photographers. These two groups had quite different attitudes to photo annotation, sharing, and privacy. The Flickr group were more organised, more willing to tag, and more open to sharing their photos without restriction.

Subsequent work has explored Flickr use and tagging in more detail, leaving a noticeable absence of research on the more mundane but pervasive practice of using conventional photo Web sites and e-mail attachment for online sharing. An indication of this asymmetry is given by recent statistics on the number of photographs in Flickr in relation to other Web sites. In April 2009, the ImageShack Web site had 20 billion, Photobucket had 7.2 billion, and Flickr 3.4 billion unique images.[45] Despite this, there are no published studies of Photobucket or Snapfish use, nor of the use of e-mail for photo sharing.

Further work on Flickr has shown that Kodak Culture people are now using the site to share photos with restricted groups of family and friends for communication and relationship maintenance, if not for memory archiving. This conclusion was based on interviews with 12 Flickr users in the US.[46] A more recent study by the same author and her colleagues confirmed this finding in a 3–5-month field trial of Flickr with 26 US participants.[47] In fact, this work replicated the MobShare and MMM2 trials with Nokia N80 camera phones and commercial software for uploading and browsing mobile images on Flickr (ZoneTag and Zurfer). It showed that, although only a sub-set of captured images were uploaded to Flickr, the main benefit of doing so was to share with restricted groups of known contacts. Additional sharing took place on the camera phone itself, via slide-show features built in to the gallery function of the device or provided on Zurfer for browsing Flickr remotely. Further studies of tagging in Flickr and ZoneTag have shown interest by early adopters in tagging to help members of the public find posted images, although most tags are designed for personal organisation or for communication with family and friends.[48] Users remain sensitive to a raft of privacy issues

[45] TechCrunch 2009.

[46] Van House 2007.

[47] Ames et al. 2010.

[48] Ames and Naaman 2007.

connected with expanding access to their personal photographs, and they worry about new dilemmas such as how to control images of them taken by others.[49]

The final chapter to date in the story of sharing photos online concerns the introduction of social networking sites such as MySpace, Facebook, and Twitter. All of these sites integrate text messaging, media sharing, and contact management in the same application.[50] Photos can be posted as personal profile images or associated image collections but serve in either case to support text-based communication as the primary function. This reverses the situation in Flickr and other photo Web sites containing text annotation and commentary, where photo sharing is the primary function. While much has been written about the network structures and social behaviours associated with these kinds of sites, their use as a means of photo sharing remains un-researched. For example, photographs are mentioned as a subsidiary motive for using Facebook, but their use within the system has yet to be examined.[51]

6.5 Offline Photo Sharing

Given all the media and research attention on the World Wide Web and its transformative effect on social communication, one might be forgiven for thinking that most digital photos are shared online today. This is not true. Online photo sharing is an important component of contemporary domestic photography in the West, as shown above, but offline photo sharing is equally important and probably more pervasive. Indeed, conventional methods of displaying printed photos in domestic settings are historically more established and are better supported than ever before with digital printing technology. Families can now order a wide range of printed photo products in person or over the Web, ranging from posters and photo books to t-shirts and coffee cups. They can also print variable-sized photographs and collages on inexpensive or portable printers of their own. Furthermore, as the infrastructure for digital photography has grown, there has been a proliferation of options for the display of images on screens. These range from the LCD screen on the back of a digital camera or camera phone to every imaginable shape and size of screen on desktop, laptop, and handheld computers, as well as on television sets, game devices, and media players. Add to these the growth of digital photo frames since 2005 and current developments in pico-projectors and tabletop displays, and we begin to see a rich paper-and-screen landscape for the display and sharing of images *locally*, as well as globally over the Internet.

The importance of co-located social practices surrounding photos has been underscored recently in a special issue of that name in the *International Journal of Human–Computer Studies*.[52] We begin with two key papers from that issue to

[49] Ahern et al. 2007; Besmer and Lipford 2009.

[50] Boyd and Ellison 2008.

[51] Joinson 2008.

[52] Lindley et al. 2009.

introduce what is known about offline photo sharing from these and other studies. In many ways, this behaviour is the most complex aspect of domestic photography to summarise, because of the number of technological options available and the absence of research on many of them. The tendency in the literature is to study the latest and most novel of options first, preferably ahead of their market launch. This is the opposite of what we need in this review to describe the ongoing or modified practices of families 'doing photography' under very new technical and social conditions. For this purpose, studies of the most popular and resilient commercial technologies are often the most instructive. We will return to this issue at the end of the chapter and book, but for now we turn to two studies that take a broad view of offline photo sharing and how it is done in the family home.

Van House (2010)[53] draws on four studies of family photography conducted with colleagues between 2004 and 2007 to outline a range of co-located sharing practices in US households. These span the use of most of the paper- and screen-based technologies mentioned above, placed and prioritised within their varying social contexts. For example, loose prints and albums are still valued as aids to storytelling and continue to be proudly displayed in frames and *ad hoc* collages around the home. Participants were aware of the memorial value of displayed images and of how they can act as 'conversation pieces' with visitors to the home. The availability of additional ways of sharing photos on-screen appears to have both extended these behaviours and made them more selective. Digital prints are likely to be fewer and more 'special' than analogue ones, and supplemented by digital photo sharing mainly on capture devices and computers. Camera phones in particular often contain collections of recent images that are brought out in conversation to illustrate a point. Larger collections are shown at home on desktop computer screens or laptop computers. Laptops are often preferred within the home because of the flexibility with which they can be positioned when compared with desktops, which may be in inconvenient locations for sharing. Families reported viewing photographs from remote online galleries such as Flickr as well as from local filing systems, giving further flexibility to the location of sharing. There was also some evidence in a minority of families of co-ordinating digital slide shows or creating digital stories. These practices echo the analogue slide shows of previous years, in which a sequence of images is shown with accompanying spoken narrative. Digital storytelling can be seen as a kind of recorded digital slide show containing the narrative normally delivered live to a co-present audience. This creative and performative potential of digital photography was stressed in the discussion of findings, and it emerged again in the following study.

Durrant and colleagues (2009a)[54] at the University of Surrey and Microsoft Research reveal conflicts in eight UK family homes over the management and display of their photograph collections. Using a creative photo selection task and phenomenological analysis of responses, the authors examine long-term practices of photo

[53] Van House 2009.

[54] Durrant et al. 2009a.

curation in the home rather than short-term practices of photo sharing. The findings show that the traditional domestic order of mothers taking responsibility for organising, displaying, and distributing family photographs is being undermined by digital technology. This appears to benefit teenage children in photo organisation and sharing, both inside and outside the home. Hence more family members in the study were able to take digital as compared to analogue photographs, including surprisingly young children who had never had access to film cameras before. Furthermore, older children and teenagers were able to file and use the images with more skill and creativity than their mothers, who felt frustrated and disempowered by digital technology. Teens assisted and collaborated with their parents in determining how they and the family were portrayed on computer displays within the home. However, they also used the technology for personal expression through printed photo collages and online photo sharing, free of parental control. This reveals a new complexity to the management of multi-author photo collections within the family, and the need for more careful design attention to the *politics* of photo display.

Together, these studies show the importance of two key factors in the organisation of offline photo sharing: the physical properties of the photo display and the span of time over which display is managed. Physicality can be broken down crudely into paper- versus screen-based representation, although many refinements of each category can be made. Temporality can also be split into long-term curation and short-term sharing, although these are relative terms with gradations within and between categories. The interaction between the two factors gives rise to four kinds of co-present sharing, shown in Table 6.1. Paper- and screen-based forms of SHARING and CURATION will now be considered in turn, as a way of structuring the literature pre-dating the above-mentioned studies and filling in details of the behaviours they describe.

Printed photo sharing is remarkably under-researched, given its importance as a commonplace form of storytelling in conversation and a source of design inspiration for screen-based photo sharing. It was first examined in detail as part of the photoware study by Frohlich et al. 2002,[55] although only a summary of findings was presented in that paper. More detailed findings on the dynamics of a corpus of 80 audio-recorded photo sharing episodes spanning 15 h of photo-talk are reported in Chap. 7 in Frohlich's 2004 work.[56] The full analysis was led by Steven Ariss from

Table 6.1 Four types of offline photo sharing

	Sharing	Curation
Paper	Printed photo sharing	Printed photo curation
Screen	Screen-based photo sharing	Screen-based photo curation

[55] Frohlich et al. 2002.

[56] Frohlich 2004.

the University of York, using a conversation-analytic approach. This involved looking at the turn-by-turn organisation of utterances in collections of transcribed episodes, for systematic patterns and dynamics. Although physical movements and photographs were missing from the audio-recordings, it was nevertheless possible to identify verbal references to images and the way in which these functioned in the activity.

Three significant discoveries were reported in the longer write-up. First, a striking difference could be heard between two types of photo-talk. This hinged on whether some or all of the participants shared the memory of the photographs being discussed. If all did, this resulted in what was called *reminiscing* talk (60% of episodes), characterised by mixed-initiative dialogue in which everyone chipped in comments, often in overlap and usually to remark on the physical characteristics of the images and identify the time or context in which they were taken. If only some of the participants shared the memory, this resulted in *storytelling* talk (29% of episodes), dominated and led by the photograph-owners to convey photo-stories and meanings to the others. Mixed groups were also found in the corpus, comprising two or more people who were present when the photos were taken, sharing them with one or more people who weren't. This resulted in a mixture of storytelling and reminiscing talk (11% of episodes) characterised by collaborative storytelling, such as observed by Edwards and Middleton (1986) in group discussion of films.[57] A second major finding was that audiences were very active participants in steering the course of the talk itself. In fact, the word 'audience' did not really apply to participants in reminiscing talk, who were empowered by their knowledge of the photographs to remark on any individual feature or association. In storytelling talk, where the audiences were those without knowledge of the photographs, they still interjected questions and expressions of interest in particular images, which served to trigger stories or steer their elaboration and closure. This interaction tended to result in the telling of stories about individual images and sometimes led to the telling of *reciprocal stories* by audiences. Finally, by examining multiple sharings of the same photos with different people, it was clear that storytellers tailored their stories to the audience at hand. This is called *recipient design* and involves attention not only to audience talk but also to the relationship between storyteller and audience member, and the impression the story is intended to make. This did **not** extend to the telling of different stories concerning the same photos, but it did affect the wording and emphasis used.

Using video-recordings of two printed photo sharing sessions from UK families, Crabtree et al. (2004)[58] point out features of the visual conduct not available in Frohlich's audio data. In the first session, four adult members of an extended family share a loose set of prints with each other and two of their young children. The photos are passed between some of the participants and also picked up freely from the pile at will. This results in distributed control of which photo is discussed at any moment, and in changing orientations and distances from which it is viewed by each person.

[57] Edwards and Middleton 1986.

[58] Crabtree et al. 2004.

In the second session, two adult members of a family are shown old family photos assembled by a third. Questions about the identity of people in the photographs are resolved and answered with the aid of various pointing and circling gestures over the images. The authors suggest that such complex behaviours are enabled by the physical properties of printed photos and will be difficult to support on-screen or at a distance. This point is also underscored by Frohlich (2004), who shows how poorly the linear 'slideshow model of photo-talk', used in most screen-based photo viewing applications, stacks up to the non-linear and interactive forms of printed photo sharing he observed.

Screen-based photo sharing was investigated directly by Lindley and Monk (2006).[59] In interviews with six individuals from four UK families in 2005, they discussed the pros and cons of various screen-based options for photo sharing. In general, screen display of photos was valued for being large-scale when compared to 6" by 4" prints, enabling image details to be seen more easily by a group. As Van House[60] did, they found that desktop computers were not always in the most sociable or convenient locations for photo sharing, leading to seating or standing arrangements wherein audience members had to 'hover' behind the photographer. The preferred arrangement was in a 'huddle' beside the photographer. This was reported to be possible with prints or a laptop when only two or three people were involved. Laptop screens were criticised for their narrow viewing angle, as was slide-show software for inhibiting conversation. As predicted by Frohlich, mentioned above, photographers reported frustration with trying to fit commentary to the speed of slide transition, while audiences complained of having to view too many photos with similar shots of the same thing. Looking at photos on a television screen from a physically connected digital camera was viewed more favourably, apart from the lower image resolution and short lead, which meant that the photographer often had to crouch on the floor beside the TV set. The authors also noted a contrast between control of printed and screen-based photo sharing, such that prints and albums were often passed to an audience whereas mouse or camera control of screen-based photos was not.

Seating and control factors were subsequently explored further in two follow-up experiments.[61] In the first experiment, groups of three friends discussed 12 photographs from a near-vertical tablet PC display, in a semi-circle or triangle of chairs (see Fig. 6.6). The photographers always sat nearest the display, and photographs were varied across reminiscing sessions (where the event depicted was known to all parties) or storytelling sessions (where it was not). Conversation measurements were taken throughout, and participants filled in user experience rating scales between conditions. Reminiscing talk contained more turns and overlaps than storytelling talk did, irrespective of seating arrangement, as observed for printed photo sharing.[62] However, sitting alongside the photographer led to significantly more

[59] Lindley and Monk 2006.

[60] Van House 2009.

[61] Lindley and Monk 2008.

[62] Frohlich 2004.

Fig. 6.6 Two seating arrangements for screen-based photo sharing (Reprinted from Fig. 3 in Lindley and Monk 2008. Original title: Two seating arrangements for screen-based photo sharing. Republished with permission)

equal and free conversation and an experience reported as better, than did sitting behind the photographer. Side-by-side seating also resulted in about twice as much socially directed gaze (i.e., time spent looking at each other), creating greater awareness of audience reaction and overall audience engagement. Similar findings emerged in a second experiment, on shared control of screen-based photographs, using three remote-control units in semi-circular seating around a TV screen, rather than one. In addition, there was more overlapping talk in the shared-control condition and participants reported a stronger element of fun when they had their own remote controls. This was mainly due to zooming in and out on details of the photos rather than reversing or advancing the photograph sequence. Conversely, a photographer holding the only remote control felt as if he was giving a formal presentation.

Related work on the vertical and horizontal orientation of workgroup displays shows that each has different affordances for collaboration and conversation.[63] Vertical displays could accommodate larger groups, which could change in size, and ensured that everyone could maintain a similar viewing angle. Horizontal displays were better for collaboration within smaller groups and facilitated more fluid conversation and role-switching. Combining these insights on working document displays with those on (vertical) PC and TV photo sharing above suggests that multi-touch tabletop displays may be optimal for screen-based photo discussions, as long as the photographs can be easily reoriented on the table. These displays are starting to be explored by a number of groups to good effect and are likely to change the landscape for live domestic photo sharing as their cost decreases (see, e.g., Apted et al. 2006 and Kirk et al. 2010).

A final development in the emerging practice of photo sharing on screens is suggested by work on handheld photo viewers. Stelmaszewska and colleagues[64] report the findings of interviews with 11 adults from the UK about *where* they shared a selection of digital photographs taken on their camera phones. While the home was said to be one of the most convenient places in which to share photographs, several

[63] Rogers and Lindley 2004.

[64] Stelmaszewska et al. 2008.

other locations were mentioned also as popular sharing sites. These included bars and cafés, which were noisy but sociable; restaurants, where circumstances were calmer and more organised; and parties in other people's homes or public venues, which were highly interactive. Camera phones were said to be shown to others or passed around groups in all of these places, often with attempts to swap photos phone to phone via Bluetooth. This was said to work well with small numbers of close contacts in quiet surroundings but not for sharing with a larger group of mixed contacts. Participants were concerned about the privacy of their personal data, the security of their phones, and the inability to explain their photographs in these conditions, leading the authors to recommend lockable folders and Bluetooth broadcast to a collection of selected phones. A variation of this idea using Wi-Fi multicasting has been explored recently in an experimental setting.[65] The authors found that groups of four friends could effectively share a photo set by simultaneously browsing it on four phones, as long as control rested clearly with one person. In an alternative approach, Balabanović et al. (2000) explored the usefulness of a single handheld tablet for collaborative photo sharing and storytelling.[66] This was tested with seven pairs of US participants, in a study in which a primary user showed photos to a secondary user and later recorded a digital story for sending to a hypothetical recipient. The larger screen allowed both members of a pair to view and point to images clearly, but the weight of the device led to its use on the knees of one participant. It was usually held and operated by the primary user, although there were some instances of shared operation and passing of a device to the secondary user. Storytelling was organised as either commentary on each photo in turn ('photo-driven') or a verbal story illustrated with related photographs ('story-driven'). Audio-recording was performed only for remote recipients and usually after all the relevant images had been assembled. As we now know, tablet viewers of this kind have not become common in the 10 years since this study was conducted. However, the new range of electronic photo frames and the recent launch of the iPad from Apple both provide new platforms from which this kind of photo sharing could increase.

Printed photo curation in family homes appears to be just as complex as printed photo sharing is. Again there is relatively little research on the topic, but such research as there is reveals a range of practices making use of the versatility of printed photographs for being displayed in different ways. Drazin and Frohlich (2007)[67] refer to these as *framing* practices because they relate to the material form in which printed photos are displayed and located for particular audiences and purposes. In a study of nine UK families in 2002, they examined framing practices as part of a more general discussion of photo sharing and annotation. Four kinds of framing were discovered. *Disposable photographs* were loose prints that were never put on display but never really disposed of either. In some ways, these were

[65] Kun and Marsden 2007.

[66] Balabanović et al. 2000.

[67] Drazin and Frohlich 2007.

Fig. 6.7 A rogues gallery of photographs and other reminders (Reprinted from Fig. 2 in Drazin and Frohlich 2007. Original title: A rogues gallery of photographs and other reminders. Republished with permission)

photographs in a default unframed state, stored away in forgotten corners of the home. *Rogues gallery* photographs were loose photographs displayed in informal collections on corkboards, fridge doors, and walls. They were often displayed alongside hand-written notes, postcards, letters, and bills, as in Fig. 6.7. This indicates their transient nature and practical purpose in serving as iconic reminders of people to keep in touch with, replies to send, or actions to perform. *Album* photographs were those selected, combined, and positioned in book form with a view to 'long-term future remembering'. Mothers were usually the creators and curators of albums. Although the latest albums were kept out and shown to visitors, older albums were archived for future reference by members of the family. *Framed* photographs were those given the most formal and prominent display, in cardboard, wooden, plastic, or metal frames. These were often of individual people and were hung on the wall or placed on a shelf near other types of objects, such as ornaments or trophies. Like these, framed photos appeared to mark and commemorate relationships, times of life, or achievements of lasting significance in the life of the owner. While photographs are usually thought of as direct triggers to remembering the past, the authors argued that photograph displays of all these kinds act as more or less public triggers for 'remembering to remember' in the future. In this respect, they announce an *intention to remember*, and never forget, the subjects featured in the photographs.

More recent work by Swan and Taylor (2008)[68] confirms and extends these findings with greater attention to the location and arrangement of particular images. From home tours and interviews with six families in London, they report collections of family relations on a mantelpiece, wedding photos on a sideboard, family portraits on a 'family wall', *ad hoc* events represented on a bookcase, and a collage of children's art in a home office. Many of these areas are said to have a shrine-like quality and were treated with considerable respect.

Screen-based photo curation is a natural extension of paper-based curation but requires a form of *situated* display that can present and refresh photographic material over sustained periods of time (cf. O'Hara et al. 2004[69]). The new class of wireless electronic photo frames, such as those by Kodak, are highly suitable for this purpose, as they provide a new and dedicated display for photographs in the home and can be fed from a variety of sources. These include a USB stick, camera memory card, or local computer, as well as a remote Web site or even a remote mobile phone. Screensavers on existing computer screens or TVs might also serve this purpose but suffer from primary use for other purposes. Surprisingly little work has been done on situated photo displays in this context, and we can find no studies examining the uptake of commercial displays in the home.

One early paper on smart digital photo frames, by Kim and Zimmerman (2006),[70] outlines the possibility of a context-aware photo frame that reacts to the presence of different users of a display to adjust its content to their interests. However, this does not seem to have been subsequently built and tested by the authors. In a development of their previous work on printed photo curation, Taylor, Swann and Durrant go on to speculate about a network of photo displays designed to work together in different ways, using photos from a shared home archive.[71] Three possible displays are introduced in this work as design suggestions, on the basis of findings about paper photo curation in 15 UK families:

- **Photo mesh** – a circular touchscreen collage that cycles randomly through photos from the home collection and responds to direct selection. It can also function as a point of upload to the collection.
- **Photo switch** – a rectangular photo display with a sliding door for presenting one photo at a time from two photograph collections. Sliding the door over one side of the display obscures a photograph from one collection, which fades to black and changes randomly after 15 min.
- **Photo illume** – a light-sensitive frame for single photo presentation that fades to black and moves on to a new image if not stimulated by light.

Each of these displays was subsequently built and exhibited in 2008, when Photoswitch was also trialled.[72] Mothers and daughters from four UK households

[68] Swan and Taylor 2008.

[69] O'Hara et al. 2004.

[70] Kim and Zimmerman 2006.

[71] Taylor et al. 2007.

[72] Durrant et al. 2008; Durrant et al. 2009.

put 12 photos each into the device and lived with it for about a month. In addition to seeing more of their digital photos displayed in the home, the participants valued showing each other their selected photos of self and family. This triggered conversation between them and others in the family about the reasons for selection and the photos themselves. This included disagreements on preferences for certain photographs, and corresponding behaviour to cover them from display or defend them from disappearing. The device was also effective in eliciting views about the relationship between the content and location of displays, the duration of image display, and the balance between manual and automatic control over photographs. Although this work does not suggest an emerging new practice for screen-based photo curation in the home, it does indicate the 'play of possibilities'[73] for more interactive, dynamic, and automatic presentation of photos than people are used to with paper prints.

6.6 Current Photo Ecologies

So far in this chapter, we have reviewed the way in which the infrastructure for digital photography has been built over the last 20 years and been adopted, piece by piece. What started as a home photo lab designed to put 'development' and printing in the hands of families themselves has ended up becoming a veritable home photo *factory* (see again Fig. 5.2, in Chap. 5). This is centred on the home computer and allows family members to capture, edit, store, distribute, and display photographs across a variety of devices both within and outside the home. Keeping the factory going is now a maintenance and upgrade job in its own right, as Norman has recently pointed out for all forms of computing infrastructure.[74] He recommends spending more time on understanding and designing the infrastructure, before it gets too complicated to manage and use. Two final pieces of work are beginning to do this, and these are described here as a way of attending to infrastructure issues in family photography and opening up the ensuing discussion of its effects on photographic practice and visual culture in general.

In a recent analysis of the everyday use of objects, Shove et al. (2007)[75] examined the adoption of digital photography by a variety of individuals in the north of England. By focusing on the photography *careers* of amateur family photographers, the authors avoid an overemphasis on particular devices and show how existing film/print skills and routines transfer to new digital/screen context and technologies. At one extreme they cite John, who simply substitutes a Kodak Easyshare C300 for his film camera and takes its memory card for processing and printing at a popular chemist's.

[73] Anderson 1994.

[74] Norman 2009.

[75] Shove et al. 2007.

At the other extreme is Louise, a teenager who, because of the cost of film and processing, has never really been encouraged to take analogue photos. Like other teenagers in the study, she has been enabled to take and share photos on her camera phone and the family's compact digital camera, which she borrows from time to time. The importance of the computer for the storage and online sharing of images privileges Louise, and others like her, who have existing computer skills they can now apply to photography. At the same time, it created barriers for some of the older members of a camera club in the study, who had to invest in new computer equipment, editing software, and associated learning in order to reap the benefits of the image manipulation previously done in a darkroom. Some became evangelistic converts, but only after considerable time, effort, and persistence that was lacking in more casual snapshot photographers.

Switching to a family unit of analysis, Neustaedter and Fedorovskaya (2009)[76] discussed patterns of photo flow through 'digital photo ecosystems', as revealed by one or more informants in each of 22 US families. They found that family members adopted different roles in family photography, according to their age, expertise, and gender. Families were able to point to individual members acting as primary capturer, organiser, and display manager, and these were different people in the majority of households. The roles were usually taken by the adult parents of each family, with more mothers than fathers across the sample. This imbalance was lowest for primary capturers (14:5) and highest for primary display managers, all of whom were mothers. The fact that different people often took these roles in each family was important for photo management because it meant that the knowledge of what photos had been taken, where they had been stored, and for whom they had been shared and displayed was distributed between individuals. This was accentuated by the fact that there could be several family members in *secondary* roles, also taking photographs, storing them, and displaying them.

This arrangement grows even more complicated when one considers the path along which individual photos travel. The authors distinguished between primary and secondary paths, which could be digital (in electronic format) or print. Somewhat surprisingly, they found that the majority of households (13) used a primary path that involved printing most of their photos. Eight of these families printed via a computer to a home printer, kiosk, or online print service, while five printed straight from the camera. The remaining nine families kept the majority of their photos in digital form, using a variety of devices on which to store and display them. This led to distributed storage of photos across devices, with considerable duplication and redundancy. The authors went on to explore a set of design concepts for ubiquitous collection, ubiquitous sharing, and automatic updating of displays, as mechanisms for unifying and automating various aspects of home photo flow. The first two concepts met with the most positive reactions but revealed additional requirements for privacy, selection, and control of images within a single collection.

[76] Neustaedter and Fedorovskaya 2009b.

6.7 Discussion

We have seen from this review that many of the same processes of innovation, marketing, and assimilation of technology as were present in the film era of photography have been evident also in the digital era. The introduction of new technologies such as the digital camera, the home photo archive, the camera phone, the photo Web site, and electronic photo displays has in each case presented families with new ways of taking and using photographs that they have had to learn, accept, or reject in relation to what they did before. The affordability of each technology and its fit with existing practices and abilities have been as important as its functionality and design in determining success in the market. Some technologies, such as the home photo printer, have met with less success than expected, because of the cost of paper and ink as compared to the negligible cost of display on-screen. Other technologies, such as the camera phone, have seen more success than expected, by extending the range of contexts in which images can be captured and making them easier to share. Even here, issues of cost and complexity have affected how images are shared, mitigating against extensive use of multimedia messaging in favour of local sharing on the camera phone screen or uploading to computers and Web sites. The current complexity of photo ecosystems and of the flow of images around them continues to provide new opportunities for family photography and support for photographic 'careers' that can grow and change over time. A major effect of all these options has been to democratise photography within the family, involving many more, younger and older, members than before and increasing the total number of photographs captured. This is also personalising photography, whereby each family member is beginning to take more control of his or her own photographs and to share them more widely outside the family, in both private and public spheres.

Given such heterogeneous technical and social context for digital photography today, it is hard to point to a single dominant design that is emerging as the replacement for the film camera and printed snapshot. The digital camera and camera phone have become the surrogate gatehouses to a network of technologies and activities that now allow images to be used in a myriad of ways. Individuals are still coming to terms with the options that suit them best as members of friendship and community groups, as well as members of their local and extended family. Hence the 'era of ferment' for digital photography is still very much with us, with little prospect of subsiding in a traditional way. Indeed, the nature of this domain casts doubt on the model of technology adoption proposed by Anderson and Tushman[77] as outlined in Chap. 2. This is something we will discuss further in the next chapter, along with how the Digital Path is likely to stabilise.

For now, we wish to note simply that the use of photographs for memory, communication, and identity is evident in all of the digital photography activities reviewed above and continues to underpin the value of these images in a domestic context.

[77] Anderson and Tushman 1990.

Although the new possibilities for image assembly, combination, and annotation have led some authors to suggest *creative expression* as a new value for digital photography today,[78] we believe this can be seen as an extension of the identity value for the representation of self. We therefore agree with Van Dijck (2008)[79] that memory, communication, and identity still provide the motivation for digital photography but in different degrees than for film photography, and with very different manifestations.

Our review suggests that communication has surpassed memory as the primary function of domestic photography, and that identity is now fighting for second place. Whereas the family album was the intended end result of family photography in the film era, the digital home archive has taken its place as a source of family memories. Online photo archives serve as memory sources for more distributed communities. Inspection of the content of these archives and the way in which they are shared reveals a large number of casual and mundane images used to show someone or other a fleeting glimpse of the *present*. From playful camera phone jokes to tagged images of pets or street signs on Flickr, many of these images have no lasting value beyond their use for immediate communication and are in sharp contrast with album snapshots selected for posterity. The practice of tagging and discussing such content reinforces its ephemeral nature: time-stamping and fixing interpretations that were once ambiguous and fluid. Ironically, the original use of the album to house *carte-de-visite* images of visitors and friends has resurfaced on social networking sites such as Facebook. Young users now craft profile images of themselves to convey changing identities and affiliations, and they collect those of friends they want to see and be seen with.

Returning to Slater's speculations about the impact of digitisation on family photography,[80] we can now see that he was right about the stability of photography's values but also about the importance of the integration of photography into a new 'economy of images'. Photo flow is now part of a new photo ecosystem, extending beyond the boundaries of the home, and is beginning to mix private with public images as Slater predicted. Individual family members can now take their own images and tell their own stories, unmediated by parental control or children's censorship. New forms of online and offline photo display allow temporary 'acts of practical communication' with images, replacing the album metaphor with a kind of rogues gallery corkboard or photograph wall for the digital age. Freedom from both the constraints of the family album and reliance on traditional mass media may ultimately lead to more democratic accounts of domestic, local, and global events, as Slater also suggested.

In the next chapter, we look back over the entire history of the snapshot to continue this speculation and make some predictions of our own. This also allows us to draw out some general lessons for the study of domestic photography in HCI, science and technology studies, and visual culture and to consider how these approaches could work together in future research.

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[78] Van House 2009.

[79] Van Dijck 2008.

[80] Slater 1995.

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