Chapter 7
The Future of Domestic Photography

A colleague told us the following story. She had given her 9-year-old son a disposable camera to take with him to a camp. This was an ordinary one-time-use disposable film camera that needs to be given to the photo-finishing service for development and printing. When her son came back from his trip, he threw the camera on the floor as if to throw it away. Her mother stated that surely he had dropped the camera by accident, and he should take it to a photo-finishing provider for development and prints. The son did not understand what his mother was talking about. She had to explain that the camera had film inside and that, for one to see the images, the film had to be developed and the images printed on paper. This was all new to her son, who said that he'd thought the camera was digital.

It is not surprising that a person born less than a decade ago had no experience with film photography or film cameras and therefore had not understood how the camera works. Perhaps more surprising in the story is that no matter what technology the camera used, the son threw it away. He obviously thought that the camera had served its purpose and now was supposed to be disposed of. He had not seen any of the images captured (although he had used the camera at camp) and was quite content with that. For the son, the camera was a device used in the moment at the time of capture. It was a piece of equipment to mark an event, people, and locations as important and meaningful. In other words, taking the camera out, interacting with people to frame a good shot, and pushing the button on the camera served the purpose of social bonding and marking the moment as special. The actual images that were captured on film were secondary and, in this case, disposable. If this was not the case, why did the son throw the camera away?

In this chapter, we turn our gaze to the future and make our predictions as to what will influence future snapshot photography. Our starting point is what we discussed in Chap. 5: in the past two decades, the infrastructure of domestic photography has changed from a film-based one into a general-purpose information and communications technology infrastructure. As our story above shows, the technological change is such that the youngest generations have very little knowledge of film photography. However, our story also suggests that not everything has changed. The son took the camera to camp and used it to capture images of people,

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locations, and events that were important for him and his friends. His mother probably had done exactly the same at the age of nine. On the other hand, the story also demonstrates that something has changed in the functions and values that people assign to snapshot photographs: the son had no desire to see the actual photos; the value was in the capture, not in the images. The son had no burning desire to see the images, put them in an album, and reminisce about them with his friends – something that older generations, such as his mother's, would find the most natural thing to do with photographs.

Domestic photography is in a state of change, or, to use the term coined by Anderson and Tushman,[1] it is in the middle of an *era of ferment*. A technological discontinuity emerged in the late 1980s and early 1990s in the form of digital photography, and that discontinuity disrupted the existing regime, the Kodak Path. Today, in hindsight, the disruption is obvious: film is no longer dominant and some of the biggest businesses in film photography have gone bankrupt. However, the dust has not yet settled from the disruption. There is no obvious dominant design such as the former symbiosis of cameras, film, and photo-finishing, and no homogeneous practice and culture like the snapshot culture of the twentieth century. The Digital Path has clearly begun, but the relationships among the actors have not stabilised to form a distinct technological path (i.e., a dominant design).

In the discussion below, we summarise what we see as the most important changes that have occurred in domestic photography in the past two decades: the sheer number of pictures and cameras; the possibilities for editing photographs; the new ways of sharing, archiving, and storing digital photographs; and – given a brief look here – the changes in the 'domestic sphere'. We also discuss changes in the social functions of photographs, the organisation of personal photographs, new domestic cameras, and the division between public and private photographs. After that, we cast our gaze into the future and discuss what we see as the main actors shaping the Digital Path. In other words, we ask what can be found as key business models, discourses, legal actions, and other actors that should be taken into account in thinking about the future of domestic photography. In the final section, we summarise our view of the issues soon to face the ICT infrastructure that forms the environment of photography technology.

7.1 What Has Changed?

As we have pointed out, the major disruptions in the history of domestic photography are not changes in the camera but changes in the recording medium for the images created inside the camera. The transition to digital imaging has practically overhauled the whole photography infrastructure and industry. Domestic photography has become one of the many functions for the devices, software, cables, displays,

[1] Anderson and Tushman 1990.

connections, service contracts, networks, subscriptions, protocols, etc. that make up the home ICT infrastructure. In comparison to the Kodak Path, the move to ICT has made the technologies that people use for photography heterogeneous and the providers of those technologies (i.e., businesses) fragmented. The major change in domestic photography technology reflects the transformation in the photography industry in general: there is no longer an unambiguous network of commercial organisations that can be called 'the photography industry'. The list of business stakeholders in domestic photography is long and diverse: camera manufacturers, phone manufacturers, phone network carriers, broadband service providers, developers of photo editing software and of photo management software, photo game developers, display manufacturers, storage media manufacturers, cloud storage services, computer manufacturers, operating system developers, manufacturers of network technology, GPS unit manufacturers, positioning services, Web search services, online photo publishing and sharing services, social networking services, photo product providers (e.g., offering coffee mugs, t-shirts, calendars, mouse pads, photo books, and prints), printer and ink manufacturers, newspapers and news services, game console manufacturers, and all other technology providers who have photo-related functions in their technology or otherwise do business using people's snapshots.

If the technology and business have changed significantly, how much have people's practices, the ways in which people 'do' domestic photography? As Shove et al. discuss, people's 'careers' as photographers are in transition and old practices are reshaped and reconfigured in this transition to fit and shape the new technology and business models.[2] On the one hand, people are still sharing, editing, publishing, storing, copying, posting, commenting upon, liking, printing, and displaying photographs – as in the days of the Kodak Path. On the other hand, the technologies for performing these activities are different from those of the Kodak Path, and so must be the ways in which these things are done. In the sections that follow, we summarise the changes in practices and uses of the photography technology we discussed in Chap. 6.

7.1.1 More Pictures and More Cameras

One of the obvious changes facilitated by digital technology is that people take more photographs than ever before. In 2007, the number of photographs taken annually in the US was estimated at between 420 and 670.[3] In addition to captured photographs, people receive digital photographs via e-mail, on CDs or DVDs, through online Web services, and so on.[4] The change in the number of images

[2] Shove et al. 2007.

[3] Shankland (2007).

[4] According to a study by PMA Foresight, 37% of US households received digital images in 2008 (PMA 2009c).

circulating globally is significant. The Kodak Annual Report in 1998 reported that 2.2 billion rolls of film were consumed globally in 1997, which means roughly 53–79 billion photographs for both professional and non-professional purposes (approx. 9–14 photographs per person, globally[5]). Measuring the current number of photographs captured globally is much more difficult, because there is no measurable consumable such as rolls of film. To give some indication, in May 2010, the social networking service Facebook was reported to be receiving 1 billion unique digital photographs weekly[6] (i.e., roughly 52 billion images a year). In other words, the most popular social networking service manages almost the same number of photographs annually as was the global number 13 years ago.[7]

The uses for the camera have changed as well. People take photographs for clearly utilitarian purposes – for example, to copy a bus schedule, to compare prices, or for insurance purposes. Photographs are also taken for immediate distant communication, such as to relay a feeling of togetherness with people who may be at distant locations.[8] Taking images for gaming is a new use for cameras that mobile phone technology in particular has enabled. Also, camera phones have made candid photography easier, as it is difficult to distinguish between picture-taking and other user interaction.

The number of cameras has influenced people's practices. Camera phones have supported picture-taking in situations where people seldom have a camera with them, because people carry their mobile phones with them most of the time outside the home.[9] The integrated cameras in mobile phones have also increased the number of cameras in a household – in particular, the number of children who have a camera of their own. No longer are the children in the family dependent on the 'family camera'; they have their own device for capturing and sharing images.

7.1.2 Editing

In addition to the possibilities and technologies for capturing photographs, the editing of photographs has departed significantly from the Kodak Path. The possibilities for editing snapshots on the Kodak Path were limited when compared to the opportunities today. Once the image had been captured, the snapshooter could

[5]The world population in 1997 was estimated at 5.8 billion (United Nations 2000).

[6]Fletcher 2010.

[7]It is good to bear in mind that photographs on Facebook are predominantly non-professional (in contrast to the Kodak statistic from 1997 that includes professional use), and that images on Facebook are only a subset of all images captured in the world. In other words, the comparison is not unproblematic.

[8]Nancy Van House discusses the concept of "distant closeness" that is achieved by capturing and immediately sharing photographs (Van House 2007). See also Kirk et al. 2010.

[9]According to Hsu 2009, 70% of mobile phones in 2008 had a camera in them.

choose the size of the print from a small number of options (often a non-default size would add extra costs), perhaps there was a choice between matte and glossy prints, and later in the 1980s and 1990s there was often a choice of getting 'doubles' or even 'triples' for a small extra fee. Any control over the actual image was beyond the snapshooter. On the other hand, the process was very simple and the technical problems with the developing and printing process were taken care of by the photo-finishing service.

The possibilities for an ordinary snapshooter to edit photographs with the Digital Path are much more diverse and complex than with film photographs. Perhaps most dramatically, right after the capture of the image, one can delete the image, which is something that was not easily done with film technology. After capture, it is also possible to edit the shape, size, lighting, colours, contrast, sharpness, tones, etc. with a variety of tools, ranging from automated 'wizards' on camera phones to full-scale image editing software on desktop computers. Because home computers have become widespread and the price of professional editing software is within the reach of non-professionals, the possibilities to edit personal photographs are almost endless.

However, the ability to edit personal photographs has not turned every snapshooter into a photography artist. First, the possibility of editing photographs has added to the overall complexity of digital photography. Compared to the snapshooting process on the Kodak Path, the process on the Digital Path is more complex, partly because there are so many opportunities to edit the captured image. Second, mastering the image editing tools requires new skills to be learned and equipment to be bought. For example, to be able to use a desktop editing tool, the snapshooter must have a personal computer, technical skill in using the computer and transferring the images from the camera to the PC, and enough skill in using the editing program. If basic desktop editing of digital snapshots is becoming the norm, basic snapshooting requires these skills and pieces of equipment. Therefore, the range of possibilities that editing enables has the risk of excluding people from practising digital domestic photography – specifically, those who do not have the skills and the equipment or the money to acquire both. We return to this potential 'digital divide' in domestic photography later on in the chapter.

7.1.3 Sharing Photographs

Sharing photographs online typically utilises technologies and services such as e-mail, multimedia messaging, instant messaging, social network services, and Web page galleries. The ability to make photographs available for viewing on the Internet has enabled the sharing of photographs independently of time and location. The person sharing the images does not have to be in the same physical space at the same time as the recipient viewing the photographs. A person in Finland can share a photograph on Tuesday, and a recipient in England can view it Thursday. This is, of course, something that traditional mail has allowed for over a century, but the difference with the Digital Path is that now there is a location on the Internet (i.e., a Web address) that one or more people can view, making it possible for a

group of people to share and discuss the same photographs without regard to time (i.e., asynchronously) and location (i.e., as long as they can access the Internet in their physical location). To put it simply, sharing photographs online enables social interaction around and about photographs over long distances and at different times.

Sharing photographs online has also made it possible to show photographs to audiences that were not probable or possible on the Kodak Path. It is possible to have relatives living in different parts of the world 'gather together' around photographs published in a Web service. Or let otherwise separate social groups (e.g., family and colleagues) view and comment on the same photographs. On the other hand, it is also possible to share images with people with whom there is no social connection. Personal photographs can be made visible to anyone with access to the Internet, which makes it possible to have viewers who are not a coherent group and/or to have viewers in numbers that were practically impossible on the Kodak Path.

Web services for sharing photographs online provide tools for helping people to promote their own images and to find images that might be of interest. One of the most popular tools is 'tagging'. A 'tag' is a keyword attached to an image, but, unlike a static keyword, a tag is often a Web link as well, and clicking on a tag activates a search for other images that have been tagged with the same keyword. For example, tagging an image with the keyword 'hamster' makes the image potentially easier to find for people looking for images of hamsters. And, as the hamster example implies, tagging an image also serves the person searching for hamster images.

Adding a tag for a photograph does not necessarily suggest passively waiting for someone to search for images with that specific tag. For example, tagging can mean naming a person in a photograph, with the naming triggering a message to the person being named. In this case, tagging is a message sent to the recipient about the photographs in the service.

Tags are of commercial value in three main ways. They provide information about the contents of images, which makes it possible, for example, to target advertisements better. Tags also connect photographs (and other media objects) together, which makes it possible to infer commercially valuable information, such as who has been where and at what time. This information can be used for advertising but also for design of products and services. Third, tags can be used to create switching costs for the user of a system. In other words, the effort required to switch to another system might be too much if the tags in the system cannot be transferred as well.

Tagging and the different ways it is used are an example of a new and popular combination of technologies, business opportunities, and people's practices in domestic photography. Tagging had its predecessor on the Kodak Path – namely, written annotations on the backs of paper prints or text in a photo album. The familiarity with old practices has probably been crucial in the uptake of tagging as a practice. However, the technical and business infrastructure in which tagging has been implemented is very different from writing keywords on the back of a paper print.

Sharing photographs on the Internet has not replaced sharing of photographs that is *dependent* on location and/or time – we call this kind of sharing offline, in contrast to online. It is still possible to take (or upload) digital images to a photo-finishing service and receive prints. However, the low cost of photo printers has made them popular devices in homes, and, according to a marketing study, 30% of photo prints

in the US were made at home in 2008.[10] The printing has, of course, changed, because the prints no longer are the only way to see the images. Printing has become selective: not everything is printed. That is reserved for only a selected few. In other words, printed photographs have become more of a luxury product made only for special occasions or specific purposes, such as gift-giving.

Another print product has gained popularity as the traditional photo print has lost its dominance: the photo book.[11] Photo books are printed books that a person can create on his or her computer, using his or her own photographs. Often, photo books have ready templates into which the user can 'drag and drop' his or her photographs, so little graphical design work is required. According to another marketing statistic, people in the US make these books mainly as family keepsakes and, secondly, simply for displaying photographs or as a gift to family.[12] Again, photo books can be seen as an extension of the over-a-century-old photo album practice in which prints were 'dragged and glued' onto the blank pages (or placed in ready-made sleeves) of albums. The transfer of this practice into an ICT context has shaped the practice, and, for example, people can give several photo books as gifts because reproduction is no longer a problem.

In addition to physical prints, offline sharing includes creating CDs or DVDs full of photographs and sharing (or giving) them. It is precisely the physicality of CDs, DVDs, photo books, and prints that make them potential gifts, unlike images shared online. The gift-giving traditions and practices related to photographs are also in flux, as the uniqueness and physicality of photographs have changed in the last two decades.

However, not all offline sharing is about giving gifts. As we discussed in the previous chapter, digital photo frames are gaining popularity. These we consider to be 'offline', although they can be connected to the Internet. They are 'offline' in the sense that they are separate from ordinary 'Web surfing' with computers and mobile phones, and often even those frames connected to the Internet are passive displays. The change in comparison to the traditional non-electronic picture frame is mainly that more than one image can be displayed, and if the frame has a network connection, the images on display can be changed remotely.

7.1.4 Archival and Storage

The digital nature of personal photographs has changed storage and archival. On the one hand, digital images take very little physical space, unlike paper prints. On the other hand, digital images are very fragile in the sense that tens of thousands of photographs can be deleted very easily without any effort. Also, the digital format of

[10] In 2008, 61% of digital-camera households in the US made paper prints from their digital images and 45% of all US households made prints from digital images (PMA 2009a, b).

[11] According to PMA (2009c), the photo book market was expected to reach $340 million in 2009. The source is not clear as to whether this is the global or the US market.

[12] PMA 2009a.

photographs is dependent on existing standards and technology supporting those standards: it is much more probable that a paper print can be viewed in 20 years' time than a digital image in JPEG format.

We return to archival and storage in the next section; therefore, here we only say in summary that the sheer number of photographs is changing not necessarily the ways in which people archive photographs (traditionally, paper prints were notoriously left unorganised in shoeboxes) so much as the ways in which people can access old photographs. These are changing dramatically because photos are so numerous and their storage is distributed.

7.1.5 Changes in the Family

In the term 'domestic photography', the nature of the domestic has changed radically over the last two decades, at least in Western Europe and the USA. What it means to be a family is now different in those locations. Although we have not looked in detail at the changes in family structures, values, and constellations, we do see the importance of such changes in shaping domestic technology. For example, Abigail Durrant has looked at intergenerational power dynamics between parents and teenagers in the context of photography.[13] Gillian Rose has studied the maternal obligations in family photography in the digital age and discusses how domestic photography is still a gendered activity.[14] Barbara Harrison draws attention in her studies to how family representation in contemporary domestic photography has been supplanted by self-presentation,[15] and this is also emphasised in the democratisation process in family life as described by Anthony Giddens.[16] Giddens draws attention to the political climate in Britain for its increased emancipation of junior family members living at home, and Durrant points out the importance of this cultural environment in the context of family photography and teenage photography.[17]

7.1.6 The Social Functions of Domestic Photography

Although practices and activities have changed in the past century, the reasons and motivations of people for 'doing' domestic photography have remained surprisingly constant. Looking at people's photographs today, we can identify the same values

[13] Durrant et al. 2009; Durrant 2010.

[14] Rose 2003.

[15] Harrison 2002.

[16] Giddens 2000.

[17] Giddens 1998; Durrant 2010.

and social functions that have been dominant throughout the history of photography: social bonding and communication, demonstration of cultural and group membership and identity, and preservation and retention of memories.

For example, in Figs. 7.1 and 7.2 on the left is a family portrait taken in a photographer's studio in 1846, and on the right is a social networking profile picture taken by the person himself in 2008. The images are visually quite different, the recording medium is different, and the cost of the image was different. Nevertheless, both served the same social functions: emphasising the social bonds between the people in the photograph, demonstrating membership in the family as ideal at that time, and preserving a memory of a specific time in the history of the family.

The visual differences reflect the family values of the time. In 1846, the solemn faces and clothing would suggest to a viewer a respectable middle-class family that has enough wealth to acquire a photographic portrait. The setting is formal, and the people wear probably their best clothes. Creating an image of the family in 1846 was a serious matter. In 2008, the faces, the clothing and equipment (the backpack), and the outdoor setting suggest to a viewer a happy and sporty father who enjoys spending time with his son. The feeling is not of formality and seriousness but of love, laughter, and intimacy. Creating an image of family life in 2008 is fun and spontaneous. Also, the photograph from 2008 is without the mother, which suggests a modern father who takes an active role in the children's upbringing. A missing mother in the portrait from 1846 would have raised questions.

Figs. 7.1 and 7.2 Constructing an image of oneself and family relations in 1846 (*left*) and in 2008 (*right*) (*Left Figure*: Unknown photographer. Original title: Adams family portrait, with man, woman, and baby girl, 1849. Daguerreotype. Library of Congress Prints and Photographs Division, USA [Reproduction Number LC-USZ6-2017]. No known restrictions on publication. *Right Figure*: © Frode Skarstein, 2008. Published with permission)

However, the functions these people had for the photograph are, broadly speaking, the same: communicating an ideal familial image and reifying the familial bonds, and also preserving a memory of a specific time. This suggests that the functions for which photography was domesticated in the 1840s have persisted for almost 170 years. This persistence is perhaps more obvious when set off in contrast to new cameras in the domestic sphere that have been domesticated for different purposes, such as surveillance and logging. We return to the domestication of new cameras later in this chapter.

The social functions have not remained unchanged, as we discussed in Chap. 6. Although the social functions and values for domestic photography have not significantly changed in the past two decades, the balance between them has shifted. Snapshots today are captured and shared more for social bonding, communication, and demonstrating a specific identity than preserving memories. Domestic photographs have become more transient than on the Kodak Path, where a dominant motivation was to capture images for future reminiscing. Today, a typical photo album is shared via a Web service on the Internet, and once it has been viewed and commented upon, it is almost forgotten.[18] Archival and long-term storage are not typical activities in the current 'fermentation' of the Digital Path. Partly this is due to new uses for photography that are enabled by camera phones and the Internet – uses that have little to do with building a visual history of a person's life. It is possible to capture an image and send it immediately to other people as a message, which is then consumed within seconds, minutes, or hours. Also, images are captured for more utilitarian purposes, as in the example of photographs of bus schedules or price tags. These images are not taken to preserve and retain memories for future reminiscing.

Another change is in children's camera ownership. On the Kodak Path, children and teenagers often could not afford a camera of their own, but today parents often sponsor and even insist on their children having a mobile phone, and that phone more often than not has a camera. As a result, there is a generation of young people who have had a camera of their own rather than a shared family camera, and their uses for the cameras and images are of interest for photography studies. However, perhaps focusing on young people's habits also over-emphasises any decline in the long-term-memory value of photographs. Often, uses by teenagers and young adults are reported as new, emerging practices.[19] Typically, young people have less interest in reminiscing on their past than older people do, and this is reflected in the uses for images. In relying on teenagers and young adults as indicators of future practices, there is a risk of overlooking that people in their teens are in a special phase in life. It is probable that today's teenagers will retain something of their current photography practices as they grow older, but it is as probable that life changes such as parenthood or moving out of the childhood home will shape those practices toward preserving memories for the future.

[18] See, e.g., Sarvas et al. 2005.

[19] See, e.g., Van Dijck 2008.

When we also take into account that the most popular social networking service, Facebook, which is the one holding the most photographs (an estimated 48 billion photographs, from 500 million users[20]), was originally designed for university students (i.e., mainly young adults), it becomes understandable that the service does not strongly support long-term preservation of memories but, rather, emphasises social bonding, interaction, and identity-building.

Lastly, for a business model, emphasising the value of images 'now' rather than 'after a decade' is less risky. Understandably, making business out of something that happens within days is more attractive than investing in something that will happen sometime in the future. In contrast, for Kodak and film technology, there was no 'instant consumption'. Because of the external photo-finishing service, the first time a snapshooter was able to view and share photographs, the images were of the past. The photo-finishing process, which took a few days before the 1-h-photo services, forced the viewing of snapshots always to be about reminiscing – about the past. Polaroid was, of course, the exception to this and anchored much of its marketing message to this fact.[21] Simply put, the memory and reminiscing value of snapshots suited Kodak's business and core technology. Because digital technology shows the images immediately after capture, major businesses in personal imaging, such as Facebook, focus less on the reminiscing and more on immediate social interaction and communication of identity.

It seems that people in the current fermenting form of the Digital Path value snapshots more for their immediate function in social bonding and in demonstrating membership than the function of preserving memories. If we look back at the Portrait Path, when people did not have cameras of their own, we see a reminiscing function but different from that in the Kodak Path. The images of people were predominantly studio portraits, and often the memory function of a portrait was that of a person and a relationship, not a 'Kodak moment' such as a child's first steps or a happy day at the beach. A Portrait Path photograph was given much in the manner of a lock of hair: to reify and strengthen a social bond, but also to make sure that the social bond is remembered.[22] The portraits were not created and given for reminiscing on certain events, holidays, or growing children – the kind of functions marketed by Kodak in the early twentieth century.

Perhaps the memory function on the Digital Path will find a new form, different from the reminiscing and visual history functions supported by Kodak. Perhaps the individuality and intimacy in photographs is valued over the social events typical of the Kodak Path. In other words, perhaps intimate moments such as kisses and cuddling are typical of the Digital Path, rather than the social events typical of the Kodak Path, such as graduation, birth of children, or family vacations. The more intimate moments shared with others seem to celebrate individuality and personality more than the socially acceptable demonstrations of familial life on the Kodak Path.

[20] Fletcher 2010.

[21] See, e.g., Buse 2010.

[22] Batchen 2004.

Nevertheless, the type of memories and reminiscing people will be able to do 10 years from now depends greatly on how current photographs are stored, organised, and annotated – on how the digital shoeboxes of photographs will be managed.

7.1.7 Unorganised Images

Another thing that has changed surprisingly little in the past two decades is that people have difficulties finding time to organise their photographs. On the Portrait Path, this was most probably not a problem, because people had very few photographs. It was in the time of the Kodak Path, when people learned to consume inexpensive film, that the problem of too many photographs started to emerge. On the Digital Path, people capture more photographs than ever in history and the problem of organisation is familiar to everyone. Rather surprisingly, the 'information technology revolution' that has taken place in recent decades has not been able to provide a solution for the problem of organising one's photographs.

The film-era cliché that people keep on postponing the organisation of their unsorted collections of photographs (often stashed away in shoeboxes) seems to hold true still. Although people still place a value on having their photographs organised, there seems not to be enough motivation to do extra work for 'preservation for future use'.[23] The result of spending no time on organising is that people have their photographs unorganised, just as in the past,[24] a significant difference being that on the Digital Path there are many more photographs than before.

Paper prints have one advantage over digital photographs that influences their organisation. Paper prints on the Kodak Path were physical objects often shared and displayed in a medium that also served as an archive: the photo album. In the album, the images were organised, annotated, and presented in a manner and format that was resilient to technological changes (i.e., independent of external technologies). This was, of course, only true when someone had made the effort of creating the album in the first place.

Digital photographs are shared and displayed often via commercial Web services that are not primarily designed for archival and long-term storage. Even if they provide archival and storage, commercial services may go bankrupt or change their policies, putting the users' photographs in danger of being lost. Digital photographs stored on personal computers, optical discs, or hard drives are not safe from business and technological changes either: standards change and can become unsupported because sustaining them is no longer commercially attractive or possible. In other words, digital photographs are much more dependent on certain technologies and businesses than paper photographs were on the Kodak Path.

[23] See, e.g., Sarvas et al. 2004.

[24] See, e.g., Whittaker et al. 2010.

People archive their digital photographs, for example, by burning images to DVD-ROM. There are strong personal incentives to preserve digital photographs, but the preservation has broader motives also. Looking at people's personal snapshots (and other visual media) as a large body of visual culture, ones sees a societal incentive to keep these visual records accessible and available for decades to come.

7.1.8 The Snapshot Camera and New Domestic Cameras

The principle of a camera has not changed since the introduction of the first photographic cameras in the late 1830s: light passes through a lens and hits a surface where it is recorded. It is the medium for recording the image that has changed, from metal plates and paper to glass plates to celluloid film and more recently to an electronic format decoded into binary numbers. Unlike the recording format, the camera has seen incremental evolution and development, without a radical change in its basic principle.[25] The camera Daguerre used in 1839 is different from a contemporary digital single-lens reflex camera (SLR) in many ways, but both still follow the same principle of capturing light to create an image on a recording medium.

It may sound far-fetched to question the principle of the camera; after all, a device not capturing light through a lens inside a small box would not be a camera. However, not only are there other electromagnetic waves to capture than light (some of which are already widely used outside domestic photography, among them infrared, ultrasound, and x-rays), but there are potential other 'data sources' to capture than light that might serve the same purpose as photographs. Once again, social networking services provide a good example.

Users of social networking services capture and share a variety of information for the same reasons they capture and share photographs: to strengthen and reify social bonds and to demonstrate culture or group membership. People share non-photographic information such as text, graphics, and sound about their social ties, family relations, meaningful locations, their feelings and preferences, important events, and so on, all of which is the kind of information typically relayed through personal snapshots. From this perspective, could the camera capture something more than just visual data?

There have already been camera phone prototypes that capture, in addition to visual information, contextual information such as location, current calendar status, and Bluetooth identification codes in the vicinity.[26] This information can then be used to infer further information, such as which people were present at the time of

[25] This is not to say that within the technologies that make up a camera there have not been radical and disruptive innovations. For example, the use of microprocessors in cameras in the 1970s was a radically new way of automating light measurement. However, it did not radically change the camera.

[26] Raento et al. 2005; Sarvas et al. 2004.

capture.[27] When this kind of context information is aggregated and processed for the snapshooter for specific purposes, then perhaps the visual information of a database of photographs becomes secondary.

There are also other changes that are forcing us to rethink the traditional camera. Camera phones were the first cameras that had an open programming interface. A programmer can write software for the phone that uses the camera as a resource just like any other sensor on the phone. For example, there are mobile phone games that use the camera as a tool in the game (pointing the camera at a specific colour triggers an activity in the game). The Frankencamera[28] is a project that brings the programmability in camera phones to other cameras, mainly high-quality SLRs. In other words, it is an example of how the camera phone has made people rethink what a traditional camera such as an SLR is.

The camera phone and a traditional consumer camera are not that far apart in their uses. Both are carried along and manually operated to capture images (still and video images), and these images are then used more or less in the tradition of the snapshots culture. But these two cameras are not the only classes of cameras in people's homes. Very different types of cameras have already entered the domestic sphere. These cameras were never designed for capturing snapshots: Web cams, surveillance cameras, wearable cameras, and virtual cameras.

Typically Web cams are separate cameras connected via a cable to a computer, though sometimes they are embedded in a laptop computer's screen. The main function for these cameras seems to be in real-time videoconferencing (or chatting).[29] Surveillance cameras have also been 'domesticated' in the sense that they are sold and used as household appliances for monitoring the household, for example, in the fear of burglary, to prevent small children from doing something dangerous, or to monitor a child-minder ('nanny cams').

Wearable cameras have become available for non-professional and domestic uses as well. Wearable cameras may be hidden in other appliances, such as pens, sunglasses, or car keys. But there are also wearable cameras that are fully visible and are used and marketed for very mobile sports such as downhill skiing or surfing. Wearable cameras are also being marketed and studied as 'life logging' devices that automatically capture images of the user's life as the camera is worn as a piece of clothing.[30] As a life-logging camera, the wearable camera suggests that the images are used for reminiscing. It further suggests that our reminiscing on the past is a data query of a database of images rather than viewing ready-made stories such as in traditional photo albums.

The fourth type of domestic camera is perhaps the most radical: capturing images on the computer screen with special 'screenshot' software (often built-in functionality of the operating system). Screenshots become linked to photography

[27] Davis et al. 2004.

[28] Adams et al. 2010.

[29] See, e.g., Kirk et al. 2010.

[30] See, e.g., Hodges et al. 2006.

when they are used to capture images from virtual worlds for the purposes for which one would capture photographs from the offline world.[31] For example, players in the virtual world World of Warcraft take so-called 'killshots' after a successful mission. According to Kristine Ask, these 'killshots' are used as proof of the gamers' guild's achievements, and as proof that the gamers were there when the mission was accomplished.[32] It does not seem far-fetched that, as virtual worlds are gaining importance in people's lives, they would start capturing images from these for the same purposes as traditional snapshots.[33]

The traditional domestic camera has not changed radically in the last few decades. The most obvious change has been the integration of a camera into mobile phones, making them the 'other' domestic camera. However, there are already other cameras in the domestic sphere that are more different from the family camera of the Kodak Path than the camera phone is. How these cameras will shape domestic photography, or how domestic photography will shape the uses of these cameras, remains to be seen.

7.1.9 Public and Private Images

The fourth change we draw attention to is the division between personal private photographs and publicly available photographs made for mass appeal. As we have discussed in the previous chapters, this division between private and public photographs has existed ever since the invention of photography. The division existed already before photography in the division between portraits and likenesses of private people, on one hand, and the lithographs and other images sold for the public; photography fell into this division right from the start.

The division does follow common sense. For example, images of family members have relevance to people who have some knowledge of, attachment to, or interest in the people depicted; and often to nobody else. On the other hand, some images simply appeal to many people, meaning that the image has relevance to a large number of people. Between a portrait that is relevant to perhaps one person and a portrait that is interesting for millions are images that can interest any number of people between one and a million.

It is when this simple fact about images is turned into business that a distinct division is created between public and private images. Public images are sold to any potential buyer, and the logic of the marketplace sorts out which images have public appeal and which do not. Private images are the ones that are not sold to the public because either there is no motivation to sell them or they are thought to have no public appeal.

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[31] Book 2003.

[32] Ask, 2010, personal communication.

[33] See, e.g., Neustaedter and Fedorovskaya 2009.

On the Portrait Path, this division into public and private was supported by the separate business models. A single portrait taken in a studio was sold to an individual customer, and that single sale of a single image had to bring a profit. A photograph with public appeal was copied and sold to potentially tens of thousand of people, and the multiple sales of the multiple copies of the single image had to bring in a profit. As we discussed in Chap. 3, metal plate photography supported the studio portrait model, and the negative/positive process supported mass production and sales.

We also discussed earlier how the almost simultaneous inventions of film photography and halftone printing further separated the businesses and technological infrastructures for public and private photographs. Private photographs were captured with consumer cameras on celluloid film and printed by an external service. Public photographs were captured with similar cameras and on film as well but were printed in newspapers, magazines, and books by means of a different process and different technology. Private photography became the snapshot culture, and public photography became mass media.

On the Digital Path we can still see the division between public and private images, but the grey area between them seems to be growing. This is partly because images captured by private non-professionals have found new ways to broader appeal and reaching of larger audiences[34] but partly also because one business model for profiting from private snapshots is advertising, the same model that is at the core of mass media. Although people's private snapshots often have limited appeal, the cost of printing them has vanished with digital technology and the Internet. For a service providing online advertising space, it makes little difference whether a single image on a Web page is viewed a million times or one million images on individual Web pages are viewed only once each; in both cases, an advertisement can be made visible to a million viewers.

The Internet has also made it easy to make one's photographs visible to a potentially large number of people. Posting an image on a public Web page makes it available to anyone who has access to the Internet, which is roughly two billion people.[35] On the other hand, someone might make a photograph available on the Internet and it would not be surprising if none of the two billion users ever saw it.

To solve that dilemma, the Internet has numerous tools and services to attract attention: photo sharing services with functionality to help viewers find images that match their interests; online forums for showing, discussing, and looking at ordinary people's photographs; tagging and linking tools for making one's photograph more discoverable; convincing a popular Web site that an image has public appeal; and, finally, buying advertisement space on the Internet to attract people to the photograph.

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[34]The availability of vast collections of non-professional photographs is eroding the demand for professional photography (see, e.g., The New York Times 2010, 29 Mar 2010).

[35]Miniwatts Marketing Group 2010.

There is also a contemporary public interest in images and photographs traditionally considered to be private. Reality shows on television are an example of public interest in images of non-famous people in intimate moments. Therefore, some images that would not necessarily have had public appeal a few decades ago might be interesting to a large audience today. Perhaps it is exactly this voyeurism into strangers' private lives and moments that is also shifting the boundaries of public and private images.

However, the basic fact that some images interest only a handful of people and other images interest millions will not change. There will most probably remain studio photography services for creating high-quality images that are important for a limited audience. There will also most probably be business in creating images for mass appeal. The change that is taking place lies between these two: images that have appeal outside the traditional social circles of family and friends but are not necessarily of interest to 'the wider public'. In addition to the new audiences made possible by the Internet, there are new potential uses for private images as well as publicly available images. Because the technical standards are often the same (e.g., the JPEG format) for the two, a photograph on a news Web page can be used in a photo book made for private family use, and a private snapshot can be made public – for example, through news services that encourage their readers to submit photographs.

7.2 Shaping the Future Digital Path

What will shape the fermenting Digital Path in the next 5–10 years? At the moment, the technologies, businesses, and practices that constitute domestic photography are still changing, and major changes have not really made their final impact. Businesses such as Facebook, Flickr, and YouTube were launched less than a decade ago, in 2004, and digital cameras outsold film cameras for the first time in roughly 2003. It is quite probable that some technology combined with a business model has been launched in the past few years that will shape domestic photography as much as, for example, social networking services have.

Rather than listing our guesses as to which prototypes and new innovations will become dominant and have an impact on people's practices, we try to base our predictions on less technology-centric actors. We draw attention to currently dominant companies and their business models, commercial incentives driving technological development, and regulation and legislation activity, and we also discuss public discourse, standardisation, and economic factors. Our rationale for this is twofold. First of all, from the history of photography it can be seen that there is no technology without a business: every technology that has become widely adopted has been integrated with a business model and a commercial organisation. For this reason, studying technologies without a business perspective seems unfruitful and limited in scope. Second, for practical reasons it is difficult to study or list even a fraction of all prototypes and innovations made in academia and industry that might

shape future photography. However, we have included some references to prototypes in the discussion above to shed more light on our argumentation.

In a way, predicting the future is easier than writing about the past: no-one can expect us to predict the future with the same precision we apply when talking about the past. Of course, we hope that at least some of our arguments will prove to be correct, and we do our best in grounding our discussion. In the discussion that follows, we highlight a handful of actors that we expect to have strong agency in shaping the future of domestic photography. At the end of this chapter, we draw together our conclusions on the themes and issues that emerge from our perspective on the future.

7.2.1 Selling Advertisements: Social Networking and Search

Two major trends in consumer information technology overlap significantly with the basic uses and challenges in domestic photography. First, seeking, organising, and analysing information is an answer to the problem of managing, controlling, and effectively using the thousands of personal photographs (and other media) that have been created. Second, online social interaction is centralised with Web services that facilitate socialising with existing and broader social networks. The undisputed champions of these two businesses (in 2010) were Google in the search business and Facebook in the social networking service business. The core business model for both of these companies is selling targeted online advertisement space on the basis of data on the use of their services. In the case of Google, the data pertain to people's search activities (i.e., search queries and selections of answers). For Facebook, the user data consist of demographics, social connections, and preferences. Targeted advertisements are considered better than traditional advertisements for mass audiences. For the advertiser they are more economical in the sense that they focus only on the desired audience. For the consumer they are more relevant, and for the provider of the advertisement space a targeted advertisement can command a higher price than traditional ones.

In the domain of domestic photography, Google provides not only a search service but also a photo organisation program, Picasa, coupled with a photo sharing and publishing Web site, Picasa Web, as well as e-mail and other communication services. The significance of Facebook for domestic photography has been mentioned quite often in the previous chapters: the site hosts around 48 billion images and has over 500 million users globally (more than any other social networking service).

We believe that selling targeted online advertisement space will play a significant role as a business model driving technological and commercial development in domestic photography. As market leaders, both Google and Facebook will therefore be important in shaping the future of domestic photography.

As mentioned above, Google provides more than a search service. In addition to the personal photography technology of Picasa and Picasa Web, Google has services for placing and finding photographs on maps, social networking services,

an e-mail service, a video publishing and sharing service, and technology products such as a Web browser and a mobile phone operating system. In other words, Google provides a set of services and products that are combined such that information from one can be transferred to another (e.g., user accounts and photographs). This also means that the company has access to information from various sources, and it can process and quantify this information for the benefit of the user and the company's core business. For example, Google processes e-mail messages both to sell targeted advertisement space and to help the user manage his or her messages. In the case of photography technologies, the information gathered and processed is, for example, location information and face recognition information in photographs. It is not clear how this information is used in targeted advertising, if it is used for that at all. Later in this chapter, we return to potential issues rising from centralising personal information such as face recognition data.

Nevertheless, the core business of Google benefits from centralising personal information and quantifying that information to best suit advertisers.[36] Therefore, the generation of personal information (e.g., location, Web browsing habits, social networks, purchase decisions, and user logs), standardisation of data, and processing of raw data into quantified information are in its interests. From this perspective, devices such as a camera are technologies for generating data (both visual and non-visual) that then can be processed and organised to provide consumers with tools for information management (e.g., to organise unorganised photographs) and to provide advertisers with targeted advertisement space.

The core business model of Facebook too is to sell targeted advertisement space, and most of the demographic information used for targeting advertisements is provided directly by the users of Facebook: gender, age, marital status, home city, religion, political views, and education. But the users also provide information such as employer, social connections, familial relations, and personal likes and interests. The social networking service provides the users of the service with tools for socialising and interaction with other people. On the one hand, the service facilitates people's social interaction, to keep the service interesting and attractive so that people keep using it (i.e., remain an audience for the advertisements). On the other hand, people's interactions keep the demographic and social information up to date and, therefore, enable the service to sell up-to-date information for advertisers. Photographs on Facebook serve both of these purposes: they make the service attractive to other people (mainly the social networks of an individual user), and they can be used to infer information about social networks and connections. However, it is not publicly known whether Facebook is a profitable company or not. Its market value is quite high (estimated at $33 billion[37]), but, because it is a private company, its profit levels are unknown.

[36] Other business models and revenue sources exist, but they are secondary to the selling of advertisement space. For example, Picasa Web sells photograph storage space to its users.

[37] See The Guardian 2010d.

Both of these companies benefit from a centralised service, from continuous use, and from collection of user data. Continuous use provides more up-to-date user data, and with a centralised service, the data can be effectively processed to provide information for advertisers' purposes. For domestic photography, this means that there is a commercial incentive for these companies to promote online photo sharing and publishing (rather than sharing personal photographs from one's own computer). The photographs are a source of personal data, such as combinations of location, time, and people that can be processed. Also, photographs are an effective way of 'locking in' a user: a person who has most of his or her personal photographs shared via a service will not move to another service if the photographs and the social networks cannot be easily transferred as well. As we mentioned, tagging of photographs within a service makes them more valuable on both sides, by generating usable information and by further locking in the user.

In addition to the business model discussed here, there is a hybrid model combining the free-of-charge use typical with Facebook and the model in which users are charged for the service. This 'freemium' model provides the service for free for most users and charges a subscription fee to a minority of users, who then get a premium service. Often the free use is covered by advertisements (e.g., in the music service Spotify and the photo publishing service Flickr), and, therefore, this model is related to the fully advertisement-based models.

However, the driving force behind the search business, dominated by Google, and the social networking service business, dominated by Facebook, is selling of online space for targeted advertisements and, thereby, effective coupling of people's social interactions and advertisement business. Making social interaction an activity surrounded by advertisements, or making purchases and consumption a topic of social interaction, is of increasing business interest.[38] These business opportunities seem to be drivers that are pushing domestic photography and social media in the direction of centralised online services that welcome the most possible data and information.

7.2.2 The Home ICT Infrastructure

The second group of commercial actors in domestic photography we identify as the providers of the domestic ICT infrastructure. By infrastructure we mean the network of devices, hardware, software, operating systems, protocols, cables, routers, screens and displays, game consoles, television sets, computers, services, and so on that together enable the use of information and communication technologies in the domestic sphere.[39]

[38]The Economist 2010a.

[39]In our use of the term, we include Web services and mobile phone technologies as components of the domestic ICT infrastructure although they physically exist outside the home or are not used within the physical home.

As we have discussed from the standpoint of domestic photography, this infrastructure is heterogeneous and fragmented: there is no single business providing the whole infrastructure, and no two home infrastructures are the same. Therefore, the set-up, maintenance, and configuration work for the home infrastructure becomes an issue. For the designers of technology, the challenge is that any new piece of technology has to operate in an infrastructure the configuration of which cannot be known beforehand.[40]

For the people living in the home, the challenge involves having to configure and maintain the infrastructure, and this 'infrawork' requires skills and knowledge.[41] Typical examples of 'infrawork' are setting up a wireless home network; configuring the transfer of digital photographs from one device to another (e.g., for viewing, online sharing, or printing); and updating to the latest versions of software, drivers, or firmware.

For businesses that sell the components of home infrastructures, this is a mixed blessing. On the one hand, it is challenging to design a compatible and easily configurable product for the heterogeneous infrastructures that people use. On the other hand, it means that people need to buy new versions of the same technology in order to keep the infrastructure working effectively and up to date. For example, buying a new digital camera often means that the size of the photograph files grows. The larger image files put pressure on the computational performance of the personal computer, the storage capacity of the home infrastructure, and the network bandwidth as well. If the home infrastructure is not updated, the newest products and services cannot be used as advertised and suggested by the technology providers. The purchase of a new, high-resolution digital camera can lead to buying a new computer and a faster broadband connection.

In this light, the growth of 'megapixels' in consumer cameras benefits, among others, Internet connection providers (through demand for faster networks), hard disk manufacturers and Web storage services (through demand for more storage space), television and computer screen manufacturers (via demand for higher-resolution displays), and printer manufacturers and printing services (through the demand for higher-resolution prints and printed products). In this kind of perpetual change – in which more computational power, more storage space, more network bandwidth, and better screen resolution are typical of domestic ICT and are often taken for granted – 'more is more' is often cited as the central mantra.[42] The components of the domestic ICT infrastructure have practically become consumables with a life cycle of just a few years.

Homogenising the domestic ICT infrastructure has benefits both for the technology providers and also for the people in their homes. For the technology provider, the benefits are in selling a variety of infrastructure components rather than one. The benefit for the home user would be that potentially the components from a single

[40] Edwards and Grinter 2001 call this "impromptu interoperability".

[41] Grinter et al. 2005 discuss the work required to make a home network function.

[42] Frohlich and Fennell 2007.

provider work together better than do components from separate providers. In other words, there are benefits and business potential in providing a variety of compatible technologies for the home or, at least, in providing infrastructure technologies that diminish the compatibility and 'infrawork' issues discussed above.

For example, Apple Inc. is a product and service provider that sells, among other things, desktop computers, laptops, operating systems, displays, camera phones, network routers, online storage space, e-mail services, television receivers, network servers, photo management and editing software, online music and video purchasing services, mp3 players, and a tablet computer. Often, Apple technologies work better together than the many non-Apple technologies do, and sometimes use of an Apple technology is the only possible option (e.g., applications for Apple phones can only be acquired through a service owned by Apple). Technology providers that provide several components in the domestic ICT infrastructure have, of course, a lot of influence on how the infrastructures will change in the future (e.g., by choosing what standards not to support[43]) and, therefore, a lot of influence in shaping domestic photography. However, linking technologies together is not without legal implications, an issue we return to in our discussion of law and regulation.

An alternative, and much advertised, business strategy for providing most of the domestic infrastructure components is to shift most of the components outside the physical home. Rather than software, hard disks, and other technologies being 'local' in the home, some of these components can be provided as a Web service. For example, the storage, organisation, editing, and archival of personal photographs can be done on remote servers and the user has only to access the data through a terminal. This is the promise of the 'cloud services': In a cloud service, the user does not need to install specific software (e.g., a photo editing program) on a computer. He or she instead runs the software through a standard Web browser. In addition to having no installation tasks, the end user does not need to maintain and install any updates either. Also, the data will be stored on a remote hard disk 'in the cloud', and there is no need for extensive storage in the home. Another benefit of the cloud is that it can be accessed outside the home infrastructure as long as there is a network connection.

As an example, it is already possible to transfer photographs from a digital camera or a camera phone directly to a Web service, edit them through a Web browser, and share them with other people either by using e-mail or by printing paper copies of them – all this can be done without the images being stored on a personal hard drive, without an editing program on a computer, and without a printer in the home.

Current Web services can be seen as 'clouds' in the way in which they provide functionality. For example, the above-mentioned Picasa Web provides photo editing in its Web service for photographs stored remotely, and the Facebook service requires only a Web browser to be used. Therefore, the centralisation of people's personal data discussed above is also a key characteristic of 'cloud' services. Transferring part of the home infrastructure into a single Web service also transfers

[43]The Guardian 2010e.

personal data (e.g., usage data, as well as personal files and information) to the control of a single commercial organisation.

In summary, the future of domestic photography technology cannot be separated from the home ICT infrastructure and discussions of the future of the businesses providing domestic ICTs. We are already witnessing a heterogeneous and fragmented infrastructure that requires skills and money to use and maintain. In response to the fragmentation and heterogeneity, some technology providers promise fuller interoperability between their proprietary components and other providers promote the outsourcing of parts of the infrastructure altogether (i.e., 'the cloud'). These providers of infrastructure components will shape domestic photography through the business models and technological couplings they promote.

7.2.3 Selling Capture: Cameras Vs. Camera Phones

We have already discussed, in previous chapters, how several of the camera manufacturers on the Kodak Path survived the disruption caused by digital technology. In particular, Japanese camera manufacturers, such as Canon, Nikon, Olympus, and Pentax, were significant businesses on the Kodak Path and still are in the current state of the Digital Path. Our historical overview in Chap. 5 also showed that camera phones have become the most popular camera in the household – at least in ownership, not necessarily in use. However, there is competition between traditional camera manufacturers and camera phone manufacturers as to how domestic photography will be shaped. Will people have a camera dedicated only to photography, will they have a camera integrated into their phone that serves all photographic purposes; or will they have both?

Both standalone camera manufacturers and camera phone manufacturers benefit from the continuous 'more is more' culture discussed above. People are buying new cameras (and phones) more often than they ever were on the Kodak Path. However, there are a few technical characteristics that distinguish cameras from camera phones. First, the consumer camera is a dedicated device with no uses other than capturing still (and moving) images. The camera phone, on the other hand, is a multi-purpose device, and capturing images is only one of its several functions. Second, because the camera phone is a general-purpose device, it cannot be optimised as a camera. In other words, the other uses (e.g., telephony, Web browsing, text messaging, and listening to music) shape the device as much as the requirements for photography do. This means that the central processing unit (CPU) of the camera phone, the operating system of the camera phone, and the size and shape of the camera phone have to take into account uses other than photography. This means, for example, that a dedicated camera can always process images more quickly than a camera phone, which means that it can process more 'megapixels' (i.e., capture images with higher resolution) more quickly than a camera phone, and a dedicated camera need not necessarily fit into a pocket or a handbag as a phone is required to do.

However, the multi-purpose quality of the camera phone enables flexibility in the uses of the camera and the photographs. The general-purpose operating system of a camera phone makes it possible to run a variety of programs on the phone, such as for editing, sharing, or transferring the images. The inherent network connection on the phone makes it possible for those programs to use network resources and connect the functionality to Web services. Also, the multiple uses of the device make it possible to utilise a variety of data in the photography-related uses (e.g., location data and social data from a calendar or the address book).

These technical differences between cameras and camera phones can be supported by different practices and values in domestic photography. A photographic practice in which the technical quality of the image (i.e., high resolution and sharpness) and user control over the capture (i.e., focus, focal length, exposure, white balance, etc.) are very important supports the use of dedicated cameras. Digital single-lens reflex (SLR) cameras with interchangeable lenses are the kind of camera that supports this type of photography. Also, computation-heavy functions (in addition to processing of high-resolution images) are better supported by a dedicated camera with a dedicated CPU than a camera phone with a multi-purpose CPU. For example, face recognition, smile recognition, and blink recognition require processing power, so current pocket cameras have these features and promote them as an important part of domestic photography.

On the other hand, the multi-purpose camera phone supports a practice in which the technical quality of the image is not of primary importance. The camera phone is better in supporting domestic photography where instant sharing of images (over the Internet) and the social interaction surrounding the images is important. The camera phone also supports photographic practices wherein information about time, location, and people is important, and the possibility to edit photographs right after capture.

The competition has already shaped both cameras. In the past few years, camera phones have been made and marketed with high-quality lenses and high-resolution CCDs. Dedicated cameras have been made smaller, and some even have a network connection function. However, network connectivity and open programming interfaces have not yet become standard features of dedicated cameras.

There is a clear difference between camera phone and camera manufacturers in the kind of photography capture devices they are making, and this difference reflects the industry structures. Camera phones are manufactured by mobile phone manufacturers, for whom connectivity and communication are important values and core competencies. By contrast, SLR cameras and smaller ‘point-and-shoot’ cameras are manufactured by companies that have been in the photography business since the Kodak Path. For them the core competencies and values are high-quality photographs and imaging (i.e., what SLRs typically represent). If these two approaches to photography are to merge in cameras that offer the best of both worlds, there would need to be merging in the industries as well: the telecommunications and camera industries. At the moment, they are clearly separate, and this separation will shape domestic photography through the technologies these businesses make available and through the marketing of these technologies.

Perhaps an indication of this separation is the statistics on camera use provided by the photo publishing service Flickr. The five most popular cameras used to capture the photographs in the service were, apart from a camera phone in first place, SLRs.[44] The 'point-and-shoot' cameras that can be said to stand between the two other camera types had not made it into the top five.

7.2.4 Regulating Photography: Data Protection and IPRs

From the history of domestic photography we can see that intellectual property rights (IPRs), mainly patents, have had a major impact on which technologies have become dominant (e.g., daguerreotypes in the 1840s) or have simply disappeared (e.g., Kodak instant cameras and film in 1982). However, in this section we do not focus on existing and future patents. Studying existing patents and predicting their future importance is beyond the scope of this book. Instead, we draw attention to other legal issues that we see as important for shaping the future of domestic photography: copyright laws, data protection laws, privacy regulation, anti-trust regulation, and also the issues of global versus national legislation. As the metadata and usage data for people's domestic photographs gain importance in Internet services, these legal issues become more central in shaping the business, technology, and practice of domestic photography.

The division on the Kodak Path between private snapshots and public mass media was not problematic from the perspective of copyright laws. The private photographs almost never became public, and within the private circles where snapshots were distributed there were no issues about who owned the rights to an image. To put it simply, the creation and distribution of snapshots did not interfere with the business of mass media, so it made little sense to enforce copyright laws with respect to snapshooters who happened to capture, for example, an image of a company logo or an artist's painting.

With the current Digital Path, the distribution of non-professional snapshots is radically different. A private person can capture an image and distribute the image on the Internet with potentially very large audiences. Much in consequence of copyright issues in the music and moving image industries, media companies are cautious about any potential copyright conflicts, and their attitude is by default protective.

The new types of self-made images and the uses for them push traditional copyright practices to their limits. For example, a screenshot capture taken from a computer game, such as a 'killshot' mentioned earlier, has dual ownership: by the person who captured the image and the company owning the game in which the image was taken. To publish a 'killshot' on a personal Web site, it is not enough to

[44] See http://www.flickr.com/cameras/ (accessed on 14 Sept 2010).

get the permission of the capturer; one also must ask the game company.[45] However, the example shows that the Internet as a public distribution channel has brought copyright regulation into the sphere of domestic photography.

As a reaction to how people use and reuse publicly available images on the Internet, a new copyright licensing scheme has been created. Creative Commons licences (or 'CC licences') provide a way to facilitate the legal use of publicly available content on the Internet.[46] The owner of a copyright can decide to retain some rights to the content and give away other rights under legally solid CC licences. In other words, the CC licensing model makes it simple for people to reuse images and other content without the risk of copyright infringement. It also makes it simple for copyright holders to retain some rights and still make the digital content publicly available. The ways in which copyrights are enforced, and the way in which these laws are shaped to better fit people's practices, will have an influence on how the boundaries of domestic photography will be drawn. The world in which domestic photography did not overlap publicly available visual media is gone, and new legal tools such as CC licensing are enabling domestic photography to expand from the closed private sphere that traditionally housed it.

In a world where the social and demographic information linked to personal photographs has greater monetary value than the visual content does, data protection has implications for the business, the technology, and people's practices. Therefore, another field of regulation that has seen much change in the past few decades is data protection.[47] As personal photographs and the metadata connected with them are being used for business purposes, the question of what can be collected and by whom becomes important. Commercial organisations that have a major role in domestic photography are collecting personal information as part of their processes. For example, as we mentioned above, the social networking service Facebook collects people's personal information (age, gender, religion, friends, family, etc.) and Google's photo sharing service Picasa Web stores face recognition information from the users' photographs. How data protection laws are shaped in the future will have an influence on how the companies leveraging personal data operate. A liberal interpretation of data protection and privacy would benefit global Internet firms, who could worry less about legal issues. A more protective approach would make companies take greater account of the privacy of their users' data and the uses thereof.[48]

Another legal issue we see affecting domestic photography is privacy regulations affecting where people can take photographs and what can be captured. Already the possibility of taking candid photographs with camera phones and other small cameras has forced some operators of swimming pools and locker rooms to

[45] Which Blizzard Entertainment grants by default if it is not for professional purposes and a single copy of the image is involved.

[46] Creative Commons 2010.

[47] See, e.g., European Union 2010.

[48] See, e.g., The Economist 2010b.

regulate camera use and enforce those rules. For example, in July 2010, the City of Helsinki forbade the use of cameras in its outdoor swimming pools, to control photography of children.[49] Family memories of summer days on the beach or at the public swimming hall might have to be accompanied with fewer photographs than before.

Also, anti-trust legislation and regulations on commercial competition can have an impact on the domestic ICT infrastructure and how a single technology provider can couple different technologies. For example, in the last decade, Microsoft has been prohibited from coupling its operating system with its Web browser. Another example is how in Finland, before April 2006, it was prohibited to sell mobile phones and network carrier contracts together. This in practice stopped network carriers from subsidising the costs of an expensive mobile phone, because they could not make long-term contracts with the customer. Once the restriction was removed and this coupling allowed, sales of smartphones increased significantly.

As becomes clear from the examples above, there is a conflict between national legislation and global Internet business and use. On the one hand, heterogeneous legislation adds complexity to Internet use, as the most appropriate legal regime becomes unclear. On the other hand, differences in legal regimes make it possible for organisations to circumvent national legislation. As an example, take BitTorrent index Web sites. The Pirate Bay found a safe harbour in Sweden, where interpretations of copyright infringement were more liberal than in other countries. For domestic photography, the various legal regimes in different countries mean that data protection, IPR enforcement, and privacy regulation in one country does not necessarily force an Internet business or other organisation to change its policy and technology.[50]

Changes in legislation reflect changes in societies, including the interests of business organisations and the attitudes and values of citizens. In the next section, we briefly discuss potential changes in people's attitudes toward personal privacy and their trust in commercial organisations.

7.2.5 Public Concerns About Privacy and Trust

In January 2010, Mark Zuckerberg, the founder and CEO of Facebook, stated: "People have really gotten comfortable not only sharing more information and different kinds, but more openly and with more people. That social norm is just something that has evolved over time." This statement was issued a month after a modification in the social networking service that moved the service's privacy settings for its 350 million users toward more open information.[51] After much public criticism in the media concerning Facebook's privacy policy and the

[49] Helsingin Sanomat 2010.

[50] See, e.g., The Guardian 2010f.

[51] Sanghvi 2009.

complexity of managing one's privacy settings in the service, the company replaced the privacy settings in the user interface with a simpler set.[52] In the announcement about the new settings, Zuckerberg wrote: "The number one thing we've heard is that there just needs to be a simpler way to control your information."[53]

Another public comment on people's privacy was made by Google founder and CEO Eric Schmidt in August 2010. He said that he believed that in the future young people will be automatically entitled to change their name in order to disown unwanted information about their past stored on social media Web sites.[54] The statement was made at a time when Google was being investigated by authorities for accidentally gathering personal data by cars mapping for Google's StreetView service, and 6 months after a privacy flaw was detected in Google's Buzz social interaction service.[55]

Both of these comments underscore how commercial information and communication technologies are shaping norms, attitudes, and practices related to privacy. The attention that these two statements have received also demonstrates how very influential global Internet companies, such as Facebook and Google, are in shaping the norm for privacy: statements about the future of privacy made by the leaders of these two companies cannot be ignored, nor can changes in the services they provide. However, the public criticism levelled at Facebook's privacy changes is an example showing that these services are influenced by public opinions and how privacy is shaped in an interaction among technology providers, public debate, and regulation. Boyd and Hargittai found that most of their sample population of Facebook users changed their privacy settings between 2009 and 2010, the time when the service's privacy policy was changed and there was public discussion about the changes.[56] There was a clear reaction from the users of the service to the changes.

Nevertheless, it is clear that people's attitudes toward the privacy of personal data have shifted. Social networking services and other Web services let people make available information such as their name, photograph, address, previous schools and employees, and so on. The motivation for doing so is for people to find each other on the Internet and to keep in touch with those people. However, the ownership of the information and the rights of the service provider to use the data for its own purposes are less celebrated and often are hidden in the legal language of an end-user licence agreement. From the service's perspective, there is a trade-off in which the users share their personal data with the service in return for the benefits the service provides (i.e., facilitating the connecting of people and social interaction among them). In summary, the service provider uses the personal data to target advertisements and personalise the service, and the user uses the personal

[52] Kirkpatrick 2010; The Guardian 2010c; The Guardian 2010b; Zuckerberg 2010a.

[53] Zuckerberg 2010a.

[54] See The Wall Street Journal 2010.

[55] See, e.g., Silicon Alley Insider 2010; The Guardian 2010a; TechCrunch 2010.

[56] Boyd and Hargittai 2010.

data to find and interact with other people (e.g., by uploading photographs), and also to personalise the service to work better for him or her.

To share information with a commercial service requires trust in that service to keep the information secure and to store that information for future use. The public debates on online privacy can be seen also in discussions about whether a commercial organisation can be trusted with personal data. As our examples in Chap. 5 showed, photo sharing Web services can go bankrupt or may change their policies such that whatever the user agreed to when starting to use the service does not necessarily hold true after a while. From the standpoint of domestic photography, trusting in commercial services is important in two respects. One must trust in the service to keep personal data secure (i.e., take good care of private photographs and the information associated with them) and, second, trust that the service simply is going to exist in the future.

The trust in services existing in the future (i.e., being available and accessible in the years to come) is not as frequently discussed as privacy concerns, although the existence of these services is critical for the longevity of personal photographs (and other media). Will the 48 billion photographs on Facebook be accessible in 20 years? Perhaps people's attitudes toward photographs as keepsakes and memorabilia are changing such that photographs are presumed to have a short life span, a few years or less. If people value their photographs as personal histories that should be retained for future generations, then trusting commercial services with the archival of photographs has its risks. However, secure and long-term archival can also be seen as a business opportunity for service providers: once people trust their personal media to a service, they have strong incentives to keep the service running and making sure the archives will remain accessible even though standards and formats might change. We return to the issue of long-term storage and endurance of the infrastructure in our concluding section.

7.2.6 Standardisation: Making It All Work Together

Standardisation work is often considered mundane and to have less appeal than designing 'cool' and 'revolutionary' applications or gadgets. Standards are also often seen as belonging to the internal mechanics of ICTs and not the concern of user interface, usability, and human–computer interaction designers – standards are something that happens 'behind the scenes'. However, standards are probably more influential in shaping technology, business, and practices than any single user interface or application. A standard means that there is consensus on how specific technology should be implemented. A standard can be a *de jure* standard, which means that it was specified by a standardisation body. There are also *de facto* standards, wherein a technology has become so dominant that it is in practice standardised.

Standards are created to enable more seamless and complete interoperability: if there is a common standard addressing how to connect two pieces of technology together (e.g., a digital camera and a printer), then it benefits both the users of the

technology and the makers of the technology. The user of the camera and the printer can use any combination of the two if both adhere to the same standard (such as the CIPA PictBridge standard). The maker of a technology, such as a printer, needs only to adhere to the standard and, ideally, all cameras that support the same standard can use that printer.

Standards can be proprietary or open. A proprietary standard includes intellectual property rights that the owner wants to keep full control of and often not disclose at all. A company in a monopolistic situation can promote its proprietary standard and force competitors to license the required technology, as was discussed with reference to the Kodak 126 cartridge in Chap. 4. An open standard can include IPRs, but often the standardisation process has made sure that the owner is automatically willing to license the rights on reasonable and non-discriminatory terms. A standard can be open and free, meaning that there are no known intellectual property rights involved in the use of the standard.

As we have discussed above, domestic photography is integrated into a domestic ICT infrastructure that is fragmented and heterogeneous. The future of the domestic ICT infrastructure depends a great deal on how the interconnections between the various components are standardised: the cables, the protocols, the drivers, the formats, and also the operating systems and middleware. Also, the long-term functionality of digital images depends on standardisation. At the moment, the dominant standard for digital photographs is the JPEG image format, which was first used in 1992.[57] However, other standards are in use, especially so-called RAW image standards that are often camera-manufacturer-specific. Nevertheless, the JPEG standard is so dominant that it stands a good chance of being accessible and usable in the future.

This is not the case with video standards and even less with metadata standards for images and other personal media. Neither videos nor metadata have such a dominant standard as JPEG. Personal video clips can be stored in a variety of file formats and compressions: AVI, QuickTime .mov, MPEG (versions 1, 2, and 4), and formats designed for DVDs, to name a few. For image metadata, two standards are widely used. The EXIF standard, from JEITA and CIPA,[58] stores technical information about the captured photograph, such as the time and date of capture, location, aperture, exposure, camera make and model, and colour space. The other popular standard is the IPTC Photo Metadata Standard, by the International Press Telecommunications Council, which is supported by other standards and applications. It enables, among other things, the listing of keywords attached to the image.

However, there is currently no popular and widely used metadata standard that is designed to support the practices of domestic photography. Both of the metadata standards mentioned above have been designed for the purposes of a specific industry. Also, there is no standard way of storing one's personal data so as to ensure portability from one social networking service to another, or to allow storage locally on

[57] International Telecommunication Union ITU 1992.

[58] CIPA 2010.

an individual's computer. One reason for the lack of such a standard is that the value of personal data has become so great that companies with access are not willing to standardise and share the data.

The future of domestic photography does not rely solely on the standardisation of image formats and metadata. Because photography is integrated into the broader infrastructure, standardisation efforts for transfer protocols, middleware, operating systems, etc. will influence the ways in which the domestic ICT infrastructure changes – and domestic photography with it. What standards will be open, proprietary, and dominant, and the purposes for which those standards will be designed, have major agency in the future of the technology, business, and practice.

7.2.7 New Photographers

Above we have focused on how commercial organisations and their business models, regulation and legislation, and public discourse can shape future domestic photography. Here we share how we believe new groups of photographers will shape domestic photography through the ways in which they practice photography. We have briefly discussed how the 'family' in domestic photography has changed; here we draw attention to three large populations of photographers: children and teenagers, older adults, and non-Western cultures.

As we mentioned earlier, the children on the Digital Path are in a different situation than those of the same age from the Kodak Path were when it comes to photography. Through camera phones, teenagers and younger children have a camera of their own that is not shared with any other member of the family. Also, because the mobile phone is often taken almost everywhere (the parents often insist on the phone being within a hand's reach all the time), the camera is available in situations where a 'camera-only' device would not necessarily be. In addition to the camera, children have access to the Internet via their mobile phones and computers. Using social networking sites, instant messaging, picture messaging, and e-mail, children can share and discuss photographs with little intervention from their parents. The kinds of photographs teenagers take and teens' photography practices have been studied[59] and found of great interest for both academics and commercial research and development. Children are also being photographed in new environments, such as kindergartens, and getting used to capturing and being captured in photos in environments outside the home.[60] How will these generations shape the practices of domestic photography as they grow older? Will they, as we have suggested, have less interest in photographs as memories and value the social interaction and identity-building functions more?

[59] See, e.g., Schiano et al. 2002; Van Dijck 2008.

[60] Lehmuskallio 2010; Näsänen et al. 2009.

Teenagers are not the only generation in an interesting socio-technical situation. The so-called baby boomer generations (born between 1945 and 1955) in the Western world will make up a significant part of the population in European countries and Japan.[61] This generation will be retiring from the workforce within the next decade and will have both a longer life expectancy and more wealth than previous retirees. The ways in which this generation takes photographs differ from the practices of contemporary children and teenagers. The baby boomer generation learned photography on the Kodak Path but have often also learned basic ICT skills. Also, older adults seem to have a more cautious attitude toward online social interaction than teenagers and young adults do,[62] although they seem to be a growing demographic in such services.[63] Nevertheless, the older adults' generation with their free time, wealth, and perhaps emphasis on photographs as memorabilia and visual history are in a position to shape domestic photography as much as children and teenagers do.

The third large population of photographers we draw attention to are people in the so-called emerging economies, mainly Brazil, China, India, Korea, Mexico, and Russia.[64] These six countries make up 44% of the world's population[65] and account for roughly one third of the world's economic growth,[66] and, because of their huge population and potential for growth, they are seen as a future lucrative market.

Photography on the Kodak Path was an industry dominated by companies from Europe, Japan, and the United States, and the practices of the Kodak Culture discussed by Chalfen[67] were very much born of Western culture. In this book, our perspective too has been mainly an Anglo-American one and predominantly Western. However, as mentioned, the emerging economies are growing, and as the purchasing power of those economies grows, they start acquiring domestic ICT equipment such as digital cameras and camera phones.

The business opportunities in the emerging markets will bring the ICT infrastructure required for domestic photography within the reach of these populations. How will the new markets shape domestic photography business and technologies? Or perhaps the technologies sold to the new markets will shape the photography practices of people in the developing world to resemble more the practices in the developed countries. In other words, perhaps the uptake of ICTs in developing economies will further homogenise the global domestic photography culture. For example, already more than 500 million people are using Facebook, which must have a homogenising effect on the online social interaction practices of those 500 million people.

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[61] Eurostat 2008; National Institute of Population and Social Security Research 2006.

[62] Lehtinen et al. 2009.

[63] Riddle 2010.

[64] See, e.g., MSCI (2010) for a listing.

[65] U.S. Census Bureau 2010.

[66] EconomyWatch.com 2010.

[67] Chalfen 1987.

7.3 Looking Forward

Photography used to be an industry of its own, a set of specific practices carried out with photography technology. Since its digitisation, domestic photography has become increasingly integrated into information and communication technologies, business, and practices. It is no longer obvious where the boundaries of the photography industry are. People's needs for social bonding, demonstrating identity and membership, and recording personal histories are practised with a variety of networked digital media (e.g., text, video, audio, graphics, and computer-generated images). The technologies for photography are no longer restricted to the camera and its images. Equally important are Web services, e-mail, instant messaging, multimedia messages, and the infrastructure that enables these.

In this sense, the practice of domestic photography today has become a practice of *social media generation and exchange*. In social media, the social interaction is emphasised, the potential for societal impact is celebrated, the message is not limited to one medium, the Internet is taken for granted, and the commercial organisations profiting from social media are stretching the boundaries of traditional industries. In other words, the technology is no longer photography-centric. It is now ICT-centric with an emphasis on immediate social interaction and personal representation over the recording of memories for future reminiscing. The core business has also changed from selling consumables to selling advertisement space and perpetually changing technology.

What does this change mean for the non-professional snapshooter? How does the change from film-based photography to the information and communications technology of social media affect domestic photography as a practice and as a form of visual culture? What kinds of design alternatives are there for shaping the future of domestic photography?

7.3.1 Complexity and Expressiveness

Looking at the gradual shift from the Kodak Path to the beginning of the Digital Path, we highlight two major changes in the technology and how it is intertwined with the world we live in.

First, from the perspective of the home photographer, the Kodak infrastructure was very simple but also very restrictive. The process of creating photographs required very little skill ('You press the button, we do the rest'), and, especially in the later half of the twentieth century, it was not expensive. Simple point-and-shoot cameras were accessible to all social classes in the West, and a 24-exposure roll of film was priced quite reasonably. However, the simplicity was achieved by automating most of the process: focusing, exposure and aperture metering, developing the film, and printing the film. There was hardly a chance to edit the image between the time of capture and getting the prints from the photo-finishing service. A person who wanted to be more expressive with his or her photography had to take the

development and printing process into his or her own hands, which is something that many people did, becoming labelled as 'hobbyists' or 'serious amateur' photographers. Taking this step revealed the complexity of the process, and skills, time, and effort were required.

The transformation of domestic photography into an ICT activity has increased the potential for expression in the editing of snapshots, but it has also turned ordinary image capture and sharing into a more complex process. To put it simply, digital domestic photography is more complex than domestic photography on the Kodak Path. The infrastructure for digital photography permits a variety of ways to practice photography (not only editing), and there is no escape from this heterogeneity and complexity. Individually, a person can do domestic photography very simply: push the button and take the memory card to a photo-finishing service for printing. However, even the simplest of practices such as this cannot ignore *other people's practices* that include various ways of sharing images over networks, editing with professional-grade software tools, creating beautiful photo books, and so on. Receiving and sharing photographs is elemental in our social relationships, and people are drawn into revising their practices in line with each other to maintain those relationships. Even the most conservative and 'Luddite' domestic photographer has to face the complexity of the Digital Path or otherwise risk becoming anti-social and excluded from social networks.

7.3.2 Increased Dependence on Infrastructure

The second major change from the Kodak Path we note is the *dependence* of domestic photography on the ICT infrastructure. On the Kodak Path, the domestic photographer depended on camera manufacturers to make new cameras, and on repair shops to repair broken ones. Also, the photographer depended on film manufacturers to make film and photo-finishing services to make prints of exposed film. If any of these businesses were to stop providing the service or the technology, the photographer would be without a functioning infrastructure. This happened, for example, in 1982 when Kodak was forced to stop manufacturing its instant photography cameras and film, and it happened again in 1988 when Kodak stopped its support for Disc film. The people who had invested in either Kodak instant cameras or Disc cameras were disappointed and had to buy new equipment if they wished to continue snapshooting. However, they still had the prints they had developed from the instant and Disc film; the photographic prints themselves were not dependent on the continuation of the film or the cameras. The prints were paper, and no device is required to look at paper prints – the prints were autonomous technology, with little dependence on the underlying infrastructure.

The shift to an ICT infrastructure has made domestic photography less autonomous and more dependent on other technologies. Digital photography depends on camera manufacturers and photo-finishing service, as photography has for 170 years, but in recent decades the dependence has expanded to cover the images

as well. Digital photographs cannot be viewed without a screen, a computer, and a computer program that understands the format of the digital images. If the photographs reside in a Web service, viewing them requires a Web connection and for the service to be accessible. As we mentioned in Chap. 5, the online photo sharing service Ringo serves as an example of how a service was terminated and personal content lost forever.[68]

Domestic photography as a set of practices and a form of culture has become dependent on technology and service providers to function, more dependent than in the era of film photography. For good or ill, domestic photography is increasingly reliant on commercial services that host the images and the interaction around them, and on technology providers that create technologies and standards. Perhaps from this perspective the heterogeneity and fragmentation of the industry is beneficial: we can distribute the dependence over several technology and service providers rather than putting all our eggs in the same basket.

7.3.3 Room for Innovation: Infrastructural Simplicity and Endurance

The complexity of the domestic photography infrastructure and people's increased dependence on that infrastructure can be taken as design challenges for future technology's development. To address the complexity of the heterogeneous networks of devices, we pose the question of how to build simplicity and usability into an infrastructure rather than single applications or individual user interfaces. To address the increasing dependence on ICT infrastructures for domestic photography, we ask how to build enduring technology that will enable people to access their photographs and other media decades from now.

The requirement for more simplicity is one of accessibility. As discussed above, the use of domestic photography technology requires special skills and knowledge of the use of the ICT infrastructure. Not only special skills are required; using the infrastructure requires financial investments in devices, services, and their maintenance. The current complexity in domestic photography runs the risk of excluding people from domestic photography on the basis of income and education.

The building of simpler infrastructures requires interaction designers and usability experts to look under the hood, so to speak. For an infrastructure to be simple, it has to be understood, and this requires breaking down the walls between user interface technology and infrastructure technology. These two fields of technology are seldom designed, studied, and discussed by the same people, at the same conferences, in the same journals, or in the same projects. There is a natural

[68]The photographs in the service were available for download for a while. The comments and the videos uploaded to the service could not be downloaded.

presumption that people working with applications and user interfaces, both of which work on top of an infrastructure, need not concern themselves with the internal structures and workings of that infrastructure. There is a division between 'above the hood' and 'under the hood' technology. For this reason, applying best practices and well-known principles of usability and building simple technology into the infrastructure are problematic. For example, running user tests on an infrastructure cannot rely on simulations and mock-ups in the same way a usability test of a user interface can.

Perhaps the main challenge in designing simple infrastructures is that there is no central owner of an infrastructure.[69] An infrastructure as a network of technologies, organisations, people, legal contracts, and interconnections is fragmented and heterogeneous. Making such a network simple requires a different approach to design, in which standardisation is critical. As we discussed earlier, the common strategy for achieving infrastructural simplicity is either to lessen the heterogeneity or to standardise the interconnections. With the first option, an organisation, such as a company, aims to make parts of the infrastructure proprietary and control the heterogeneity by providing a set of products and services that inter-operate together better than technologies from other providers. With the second option, the goal is to pursue open and standardised interconnections that enable variety and choice in the components of the infrastructure. Whether simplicity can be achieved through a closed proprietary system or an open network of components is something for designers, policymakers, consumers, and businesspeople to think about. We see room for innovation, potential business, and future research in making infrastructures simpler and more usable.

The challenge is to build enduring technology at a time when technology seems to be in a state of continuous change. As part of this, we see demand for a service or a product that ensures the long-term archival of personal photographs and other media. We believe that people will continue reflecting on their personal and family histories, and photographs and other media will play an important role. We also believe that photographs, video clips, blog posts, status updates, and e-mail messages are an important source for understanding societies' and people's everyday life from a perspective broader than that of an individual. In other words, photographs and other self-made media have a cultural value in addition to individual personal value.

An enduring technical solution would also require an organisation that lasts a long time and whose goal is long-term archival and accessibility. Such organisations are typically museums or public archives, but also more commercially minded organisations have the potential to persist for decades, especially if that is in the interest of their clients and customers. That organisation would be trusted with people's personal media and with keeping them accessible even if standards for file formats, image compression, and metadata change (i.e., curation work). Long-term archival of millions of digital images and other media, and the curation of the images, creates significant costs that require a business model to cover them as well as innovative technology to make the service accessible and easy to use.

[69] Norman 2009; Star 1999.

We also emphasise standardisation of technologies in domestic photography for ensuring archival for decades to come – especially open standards. Openness in standards such as image formats, transfer protocols, and metadata ontologies would enable free competition among providers of archival services, and also allow people to archive their images in several places, to reduce the risk of dependence on a single provider. Perhaps an open-source technology with a business model to cover the costs would be a solution.

In the following chapter, we finish the book by discussing future research in domestic photography, and especially, the lessons we have learned for each of the three main academic fields we have applied in our study: human–computer interaction, visual studies and photography, and science and technology studies.

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