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From PhotoWork to PhotoUse: Exploring Personal Digital Photo Activities

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From PhotoWork to PhotoUse: Exploring Personal Digital Photo Activities

People accumulate large collections of digital photos, which they use for individual, social and utilitarian purposes. In order to provide suitable technologies for enjoying our expanding photo collections it is essential to understand how and to what purpose these collections are used. Contextual interviews with 12 participants in their homes explored the use of digital photos, incorporating new photo activities that are offered by new technologies. Based on qualitative analysis of the collected data we give an overview of current photo activities, which we term PhotoUse. We introduce a model of PhotoUse, which emphasizes the purpose of photo activities rather than the tools to support them. We argue for the use of our model to design tools to support the user's individual and social goals pertaining to PhotoUse.

Keywords: digital photography; PhotoUse; contextual interviews; design research; interaction design

Introduction

Nowadays most of us deal with unprecedented quantities of personal media, such as photographs, messages, status updates, and e-mails. Some of these media we create ourselves, and some we receive from others or result from our use of new technologies. The study presented in this paper describes the use of personal digital photos, one of the most prevalent records people keep of autobiographical content. Photos can be considered digital objects as long as they exist in digital form (Kirk, Sellen, Taylor, Villar, & Izadi, 2009), e.g., on camera SD cards, computer hard drives or cloud storage.

Before the introduction of digital photography, the size of an individual's photo collection was in the order of hundreds, and now it is in the order of tens of thousands. This changes not only the nature of the tools needed for using them, but also the significance and the way in which such collections may support autobiographical memory processes. People use their personal digital photo collections regularly, e.g., to

browse them, organize them or share them. Our work builds on the seminal PhotoWork paper by Kirk et al. (Kirk, Sellen, Rother, & Wood, 2006) in which the activities that lead towards sharing of digital photos are described in a model. In our research we are looking at activities that involve the personal use of digital photos, to identify opportunities for design of novel supportive tools. The majority of domestic photo collections contain photos related to holidays, birthdays and other personal events. But other kind of photos end up in our collection as well, such as saved internet images, screenshots, snapshots of receipts, boarding passes, etc. In the remainder of this paper we refer to all the activities that involve the use of any of these digital photos as *photo activities*, covering the moment that a photo is captured or collected, to the moment it is used for e.g. formative, communicative, experiential or remembering purposes (van Dijck, 2008). In our research we are interested in the relation between media and remembering, so the remembering purpose is of special interest to us. The photos that we capture or collect for our personal collections often acquire personal value as external representations that can cue autobiographical remembering (Hoven & Eggen, 2014). The autobiographical value of photos can support our interactions with others, e.g., telling the story of one's holiday while viewing a slideshow of pre-selected photos.

Great leaps have been made in capturing moments and experiences and creating digital records, e.g. see (Frohlich & Tallyn, 1999; Hodges et al., 2006). As a result, we have too many photos, and people lack the time, the tools, and the patience to organise them effectively (Bergman, Tucker, Beyth-Marom, Cutrell, & Whittaker, 2009; Kirk et al., 2006), which hinders them from fully enjoying their photo collection. The challenge emerging pertains to how to help people to better curate their collections of digital photos. Curation in the context of digital media involves deciding on what to keep and in what format and structure to preserve it, how the information can be retrieved, and

deciding on the methods of capturing, (re)presentation and reproduction (Van House & Churchill, 2008).

This paper describes an interview study involving 12 participants that examined how people use photo collections at home with the aim to identify opportunities for better supporting photo activities for remembering purposes, through interactive technology. In the next section we review related work, then we present the aims and methods of the study, and summarise its results. We introduce the term PhotoUse to make a distinction between the *purposive use* of photographic material, and the *work* that is associated with e.g. managing, organising and retrieving photos. We present our model of PhotoUse, with the aim to illustrate our holistic view on the personal and social use of digital photos, and discuss the implications for design and research in this field.

Related Work

In this section we discuss related work within the fields of Human Computer Interaction, information science and psychology, surrounding digital photo activities.

Photo Technology

In 1998, Frohlich et al. provided an inventory of activities that are related to the use of digital photos for sharing. The hardware and software tools that are required to facilitate these activities were described as *PhotoWare* (Frohlich, Kuchinsky, Pering, Don, & Ariss, 2002). There are many examples reported in related literature of devices designed to enable people to display and share their photographs. E.g. *PhotoBox*, a wooden box that slowly prints digital photos to display them (Odom et al., 2012); *Shoebox*, a combination of storage and display (Banks & Sellen, 2009).

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Sharing and commenting on digital photos used to be a complicated task, e.g. (Frohlich et al., 2002), but many opportunities have been addressed by commercial technologies that enable us to share and comment on photographs instantly (e.g. Flickr (Flickr, n.d.), Instagram (Instagram, n.d.), Dropbox (Dropbox, n.d.), Facebook (*facebook.com*, n.d.), Whatsapp (*whatsapp.com*, n.d.)). Recent example tools for sharing and storytelling (e.g. *Cueb* (Golsteijn & Hoven, 2013), and *4 Photos* (O'Hara et al., 2012)) demonstrate the influence of such technologies on our communication, with the new possibilities to share experiences and activities. Notable examples of research works that deliberately support autobiographical remembering include *Living Memory Box* (Stevens, Abowd, Truong, & Vollmer, 2003), and *The Family Archive* device (Kirk et al., 2010). These designs incorporate the contextual and chronological information to display a family archive. They also address multiple users, opportunities for storytelling, and the need for *curation*, which is important when designing for media-supported remembering, e.g., (Van House & Churchill, 2008).

Research into browsing, sharing, or viewing photographs is usually not concerned with curation, although selecting the required subset of the photo collection is a crucial prerequisite for successful viewing and sharing (Whittaker, Bergman, & Clough, 2010). Moreover, research into photo browsing typically approaches photo collections as databases rather than cues for remembering, thereby ignoring important activities such as reminiscing and storytelling, and instead focusing on media retrieval tasks. However, from the perspective of photos as memory cues, the experience of remembering is more important than accuracy of retrieval.

Most applications have made use of new interaction techniques that are supported by smartphones or multi-touch surfaces, to make pleasurable and efficient

manipulation and access to photo collections. This though does not suffice to address the difficulties of organizing or retrieving of photos in its totality.

Photo Activities

Studies that describe how people use their collection have focussed on managing collections e.g., see (Rodden & Wood, 2003), tools for efficient search, and retrieval e.g., see (Whittaker et al., 2010). They identify design opportunities to support these activities with new tools. Kirk and colleagues (Kirk et al., 2006) introduced a descriptive flow-chart model covering the most common interactions with digital photographs between capturing and *sharing*, which they termed PhotoWork. This model can be used to develop and assess new digital photo management tools. It identifies three stages between capturing and sharing photos:

- *Pre-download stage*: just after capturing a picture; includes triaging on the capturing device
- *At-download stage:* when transferring pictures to the computer; includes triaging on computer, editing, organising, filing and backup
- *Pre-share stage:* work that is necessary before being able to share the picture; includes sorting, selecting a subset, simple editing, copying, printing, sending

The PhotoWork model provides a linear, waterfall-like description of the lifecycle of a digital photo file, with a clear progression and separation between capturing, organising and sharing of photos. Figure 1 shows the PhotoWork lifecycle by Kirk et al. as it appeared in (Banks, Duffield, Sellen, & Taylor, 2012)**.** Kirk et al. suggested that the activities listed in the PhotoWork model consume all the time that people are prepared to spend on their growing media collection (Kirk et al., 2006). Several designs (e.g. (Hilliges, Baur, & Butz, 2007)) have been based on the

PhotoWork model, exploring technological solutions within the stage-based framework it provides. However, the steps described appear to be those that photo technology necessitates rather than how people want to do things. As a model it also draws attention to user *tasks*, such as curation, and designing for their efficient performance rather than opportunities to design for an enhanced user *experience*.

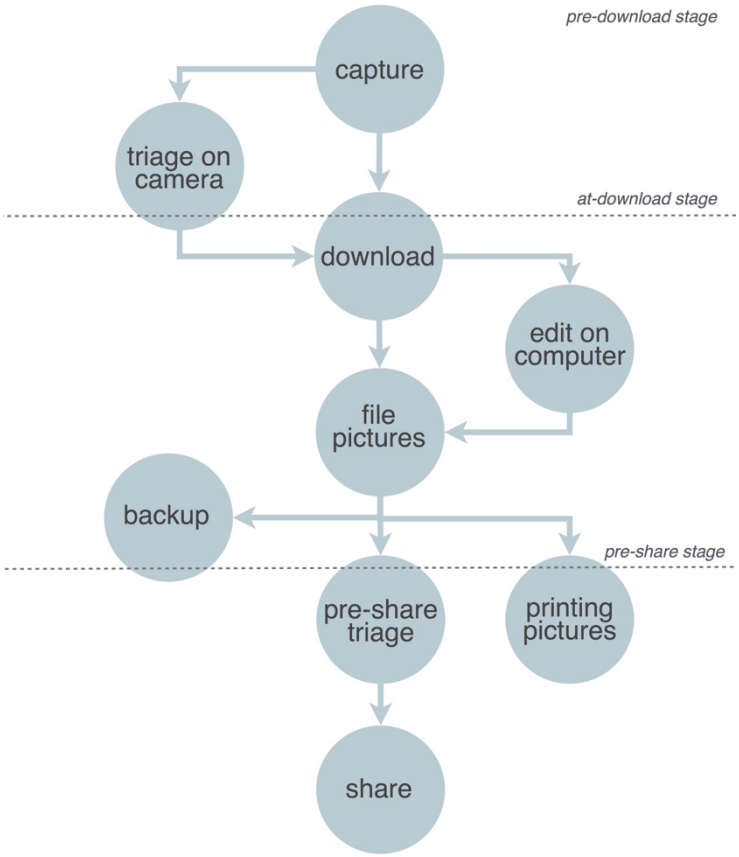

Fig. 1: Model of PhotoWork by Kirk et al. (2006), as appeared in Banks et al. (2012). Permission for using the figure are pending.

Photo Purpose

To further underline the importance of research into digital photo use, let us consider the value of photos for different purposes. In the analogue era, personal photos mainly served autobiographical remembering, and archiving the family history (e.g. (Sarvas & Frohlich, 2011; van Dijck, 2008)). Photos can serve as cues for the memories of the

events in our own lives: our *autobiographical memory* (AM) (see e.g. (Conway & Pleydell-Pearce, 2000; Hoven & Eggen, 2014; Tulving, 2007)). Memories themselves cannot be stored as a digital or other record, but are *reconstructed* every time they are recalled (Guenther, 1998). What can be stored, are the external items that can cue the reconstruction of memories (Hoven & Eggen, 2009; Sellen & Whittaker, 2010). This implies that curation of memory cues is an important aspect of media-supported autobiographical remembering. In the last two decades the purposes of photos have changed along with the advancements of digital photography and camera phone use. Especially in the younger generations, the use of photos for communication and identity formation are more prevalent than using photos for remembering purposes (van Dijck, 2008). But in line with the arguments of van Dijck, we believe that the remembering purpose of digital photos is still very important, and helps determining the value of the photos. Petrelli & Whittaker (Petrelli & Whittaker, 2010) argue that digital items are valuable, though compared to physical items they are not very frequently accessed, because they are hidden away in our computers. However, digital photo collections are increasingly more valuable for cueing our memory.

Photo Curation

Although we are putting a lot of deliberate effort into building photo collections that portray our lives, the poor organisation makes it harder to find the photos (Whittaker et al., 2010). Whittaker et al. reported that software tools intended to support retrieval activities fail to aid the process of photo retrieval activities in families, and found that their participants were not successful in almost 40% of photo retrieval tasks (although long-term retrieval is the major motivation for families to capture the photos) (Whittaker et al., 2010). Other issues concerned remembering the storage location of items, and the amount of time it took participants to find items in their collection (up to

4 minutes), mainly caused by the large amount of photographs to search through. Whittaker et al. concluded that there is a need for new tools to filter, evaluate, maintain, and share photo collections to enjoy their value (Whittaker et al., 2010).

Despite their intentions to get organized (Frohlich et al., 2002), on most occasions people lack the time and motivation to properly curate their personal photo collections. Existing studies emphasise that "work needs to be done" when it comes to organising photos, thus illustrating the understanding that curation is considered unsatisfying work, despite the promise of a well-organised collection (Frohlich et al., 2002).

An example of the efforts in research to specifically address the curation issue of digital photos is *Pearl* (Jansen, Hoven, & Frohlich, 2014), which projects multiple photos on the wall, allowing participants to select, favour and organise the content while viewing. Despite these efforts, there is as yet insufficient understanding how to design photo retrieval solutions that reduce the workload of curation, and focus on the pleasurable photo activities.

Field Study

The aim of the study was to explore photo activities in the home environment, identifying what kind of photography related activities participants engage in, and in what fashion they engage with their collection. To make this inventory we conducted in-depth contextual interviews in the homes of the participants and analysed the results using open and selective coding (Corbin & Strauss, 2008).

To create an overview of digital photo activities, and the opportunities for supportive tools, we interviewed 12 participants about their use of personal digital photography. The study described in this paper focused primarily on the home environment, because at their homes, people typically have the possibility to access

their entire personal collection, and have the opportunity to demonstrate their usual practices to the researchers. We explored all possible photo activities of our participants in this context, including all existing technologies used as retrieving devices – such as the use of smartphones, laptops, smart televisions and tablets.

Participants

The 12 participants, 6 male and 6 female, were recruited based on their photo use and social situation. The participants differed in age, profession, demographics, social situation, and interest in digital photography, to provide a broad overview of personal photo usage. Participants were selected based on whether they are well acquainted with digital photography, whether they own a digital camera and/or a smartphone, whether they live with a partner (and/or children), and whether they own a collection of at least 2,000 digital photos. The latter requirement was formulated to make sure that the participants would have experience with curating digital media. The selected participants were mentally healthy, well-educated Dutch people between the age of 18 and 69 (mean = 39.7). They owned minimum 2,000, maximum 300,000 photographs (mean = 42,083). The participants were socially active, both online (social media) and 'off-line' (friends, sports clubs, societies, etc). Three participants were not living with a partner at the time, but shared an apartment with friends; eight of the participants lived with their partner, from which four had children. The youngest participant still lived with his parents.

Procedure

Participants took part in a semi-structured interview, lasting 1 to 1.5 hours. The interviews were held in the homes of the participants, to give us a clear understanding of the context, the practices and tools, and the issues that were encountered by the

participants. In the first part, the interview focused on understanding how participants use photos. The participants were asked to talk about their photo activities, how often they use their photo collection and how much time they spend on it. The explorative nature of this research required an open interview approach, in which participants were asked to explain as many photo activities as possible in detail. When usual practices of the participants were mentioned, the participants were invited to demonstrate a typical photo activity by showing a few digital photographs, using the tools and procedures they would normally use to browse and view their photos. After the demonstration participants were asked to talk about the purpose of their photo activities, with questions such as *"Why do you want to make a printed photo album?"*. By elaborating on the purpose of using photos, participants were invited to reflect on whether current activities facilitated the purpose adequately, and to think about possible improvements. All the interviews were audio recorded and transcribed in full. The photo activities that participants demonstrated were captured on video, for later reference. At the end the participants received instructions to estimate the size of their entire digital photo collection, across devices (external hard drive, laptop, PC, Mac, smartphone and tablet). The estimation was based on the file counters in the software they used (Picasa (for web), Aperture, iPhoto, native photo applications on smartphones and tablets), or the file count property for the appropriate folders in Windows Explorer. The estimation was made based on the total count, rounded to the nearest thousand.

Analysis

The interview transcripts were analysed with a focus on identifying the detailed activities described by the participants, and, where possible, identifying the purpose. This inductive analysis was done based on the method of open coding, as described in (Corbin & Strauss, 2008). The qualitative data analysis was aimed at identifying

interesting patterns in the use of photo collections and problems that participants experience with their photo activities. To find the codes for the categories, the open coding procedure followed the operational approach discussed in (Corbin & Strauss, 2008). We were interested in generating theory and hypotheses about what motivates people to engage in photo activities, by relating behaviours to needs and motives, rather than describing activities at a phenomenological level. After analysis, the important quotes were translated from Dutch to English.

Results

In this section we will share the most important observations that emerged from the analysis.

Photo Activities

The participants provided descriptions of 171 photo activities. In this section we will describe the activities, by giving a description and examples from the participants. Of importance when trying to describe the photo activities are the differences between activities. For example: the difference between the activities *managing* and *organising* is very subtle, and the distinction for labelling was made on a technical level: managing in our definition includes everything that is done with the digital files; we see that organising is done using the metadata of the files. Another example is *triaging* vs. *sharing*, which in many cases occur simultaneously; sharing a story with friends usually involves browsing, and so these labels were often applied together. The distinction was made whether the focus of the activity was on the social aspects (labelled *sharing*), or on memory retrieval (labelled *browsing*).

Based on the characteristics, the comments of participants regarding their photo activities were divided into 13 activity categories (see Table 1 for the two level

classification), and then divided into four activity types: *accumulating, curating*, *retrieving and appropriating*. The accumulating type contains all the activities that are responsible for expanding the photo collection; curating is done in order to manage and edit the existing collection; the retrieving type is the largest and contains all the activities that are done in order to find, browse or view photos in an existing collection, which is needed for most other activities; appropriating consists of all the activities that are done in order to share or show photos, either digital or physical. An overview of the activities categories and types can be found in Table 1.

Photo activity category	**Photo activity type**
Capturing	Accumulating
Collecting	
Triaging	Curating
Organising	
Managing	
Editing	
Browsing	Retrieving
Viewing	
Searching	
Sharing	Appropriating
Printing	
Tinkering	
Collaging	

Table 1. Two level classification of photo activities, based on the descriptions of the participants. Based on their characteristics the 171 activities from 12 participants were divided into 13 categories, and the categories were then divided into 4 activity types: *Accumulating, Curating*, *Retrieving*, and *Appropriating*. The columns are divided into *Photo activity category* and *Photo activity type.*

Accumulating

People engage in activities that are part of the process of expanding a personal photo collection, starting with *capturing* the photos. The activities that are part of *accumulating* photos are the following:

- *Capturing*: taking pictures; on-device quality triage to determine retaking the picture
- *Collecting*: adding pictures to your collection, which you did not capture yourself

On-device triaging is done as part of the capturing: camera phones and digital cameras have the feature to immediately assess the picture quality, and discard and retake in case the quality is not good enough:

> "Sometimes [I do the selection] on the camera […] if it is clear that the picture is not usable" - P10 (female; age 34; 3000 photos)

The other accumulative activity is *collecting*. It involves getting images from friends or family members, images from Internet, scans from newspapers, etc. P09 explained the trouble she had with getting images in her collection that other people took:

> "My brother, my father and my husband all make pictures which need to be added. I curse them for throwing away the EXIF data […] [because] I have to add this manually […] and that takes way more time" – P09 (female; age 38; 28000 photos)

The collecting activity is important when broadening the scope of 'media' beyond photographs, which poses an additional challenge: every type of memory cue that we need to curate, but is not created by ourselves, may at some point in time include media that we do not yet consider as autobiographical digital media, e.g., public transport timestamps or electronic shopping receipts. These media need to be considered in future curation solutions (see (Whittaker, 2013)).

Curating

There are many different activities that people engage in to curate their collection. Participants were engaged in *file managing*, *organising*, *triaging*, and *editing* pictures in their collection. The activities are listed below:

- *Organising:* tagging, moving, categorising, naming, captioning, archiving, deleting
- *Triaging*: assessing, selecting for a specific purpose (e.g. sharing, decorating, presenting)
- *Managing*: filing, backup, downloading, uploading
- *Editing*: retouching, cropping, combining, correcting, changing

Some of the participants took organising of photos really serious:

> "I have several scripts [on the computer] that rename the photos based on year, month, day, minute, second. And then they are automatically moved to a folder, which is imported into Aperture, per year. And recently I sometimes create a *smart folder* with a specific start and end date" - P09 (female; age 38; 28000 photos)

Triaging is reported to be one of the most burdening parts of curating, unless it is done when the participants require a specific subset of their collection:

> "Only if I want to start a new project or a photo album or a collage […] but otherwise I would not browse through [my photos]" - P03 (female; age 30; 18000 photos)

> "It depends […] especially after traveling, everything goes onto the computer, and then there will be a round of selection, and a selection round for the photos that I want to be able to see more often, which I put into a Dropbox folder to be able to view them on another computer. And [some go] into the shared folder with my boyfriend. So then I am actually selecting three times" - P10 (female; age 34; 3000 photos)

Editing occurs when multiple copies are being generated for editing, and thus the collection is expanding. E.g., P01 and P09 had many copies of pictures that they had retouched or had changed into black/white, but of which they had kept the originals. Some participants really enjoyed editing:

> "[after the holiday] I will do some editing, yeah, for a couple of days" – P02 (male; age 29; 25000 photos)

> "I love making the picture […] creating a good end result […] is very satisfying" - P08 (male; age 40; 300000 photos)

Curating is important, because it is key to the success of the rest of the activities. The variety of activities in our study revealed that for different occasions a different subset of the collection is needed:

> "These [Picasa] folders are to show to other people […] And I sent these photos to the manager of a museum shop, for inspiration." - P07 (female; age 66; 40000 photos)

> "After my children were born I made folders for sharing and especially the grandmothers liked that. In Picasa I had a shared folder with a few people […] in which I put the most beautiful photos. I did that until 2012, and after that I did not have time for it anymore. Which is a shame because those are the folders that I actually look at." - P09 (female; age 38; 28000 photos)

This is also in line with the findings of e.g. Odom et al. (Odom, Zimmerman, & Forlizzi, 2011) that people experience the need to express themselves differently in different situations. The variety of activities that we found seemed to depend on the audience and the context. This form of identity-display in different social contexts, established using digital photographs, was also reported by Frohlich et al. (Frohlich et al., 2002).

Retrieving

The retrieving type consists of all the activities that are done in order to interact with the file system:

- *Browsing:* e.g., browsing (casual viewing of pictures while interacting with them)
- *Viewing:* passive viewing of slideshows
- *Searching:* e.g., goal-directed retrieving, searching

Participants enjoy browsing, and especially browsing on mobile devices is often done to pass the time:

> "I guess just on the couch, being bored. Or during boring moments, in the train or something. When you have nothing to do, and are sitting alone. […] I really forget […] many situations you know, and when you see the photos you start to think about it, which brings back the memory. And that is of course nice when you are bored, because then you think about pleasant moments." - P02 (male; age 29; 25000 photos)

> "[Browsing happens] on my phone sometimes. When I am thinking "I am going to browse through my photos, that'll be fun"…actually when I am bored." P12 (male; age 18; 2000 photos)

> "The only moment I look at my photos is when I connect my iPhone to my computer, because then iPhoto opens and then I look at the photos for a while. […] if it is just in front of me, that is more likely to happen than that I think of a specific moment and start to search for that specific photo." - P03 (female; age 30; 18000 photos)

Searching was reported to be cumbersome, especially when participants own large collections and do not access them very often. Many of the activities of other types start with accessing the file system.

Appropriating

With appropriating we mean to cluster the activities that are part of modifying and/or sharing (physical) instances of the digital collection:

- *Sharing:* remote sharing (online, on social media, sending postcards), collocated sharing
- *Printing*: printing photos, a poster, or family albums
- *Collaging:* making a collage from (printed) photos, making (digital) booklets
- *Tinkering*: tinkering with printed photos, cutting and pasting printed photos

Printing includes printing selected photographs, and using online services to layout and print photo albums. P03 explained why she makes printed albums:

> "You frame the memory; the album is always about a specific moment […] and in an album you can recreate the atmosphere […]. And it has to look nice of course […]. It is also about just 'owning', because a beautiful small album will still be the same small album in 100 years' time […]." - P03 (female; age 30; 18000 photos)

Most of the participants engage in some form of *sharing*. Some of the remote sharing included social media, others used email, others engaged in collocated sharing.

> "[after the holiday] I sent some photos to my parents [via email], saying "I am home again, here are already ten photos; the rest will follow soon" - which never happens" - P04 (male; 28; 2000 photos)

> "When we were rebuilding our house, I would often open Aperture […] that was nice, many people were interested to see what [the house] used to look like" - P09 (female; age 38; 28000 photos)

> "I brought the booklet that my parents made for my 18th birthday. […] The first few days I went through it once every day. […] I also show it to other people; everyone who comes here." - P12 (male; age 18; 2000 photos)

The appropriation activities that were reported by the participants are in many occasions linked to activities in the *curation* category, which illustrates that participants spend a lot of time selecting and editing the subset in order to *share*, or otherwise use the result of their work.

New Technologies: new Behaviour

Although most of the activities that we found could be mapped onto the previously mentioned PhotoWork model (Kirk et al., 2006), the temporal sequence appears to be more varied, without a distinct start and finish. Figure 2 illustrates an example of the multi-threaded and iterative process of the photo activities that we found: the case where browsing through your photos reminds you of a set of photos of you and your friend, which you decide to retrieve, select (*triaging*), crop (*edit*), print and send (*share*). A single activity has then moved rapidly through several activity categories. The dotted line in Figure 2 illustrates that the PhotoWork process is one of the possible sequences of use, and that the activities from the PhotoWork model are still present in current practices, but not necessary as a temporal bounding process.

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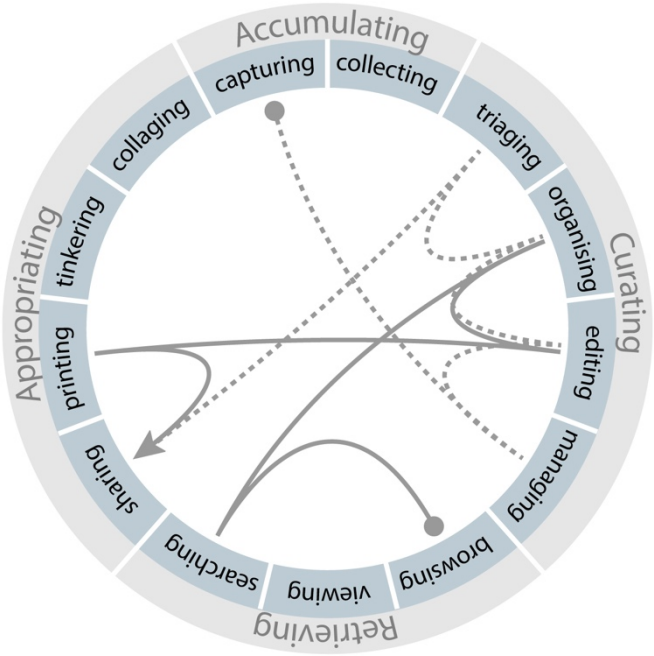

Fig. 2: Overview of all photo activity categories and activity types. In the figure all the photo activities categories and photo activity types are displayed in a continuous model. The outer circle displays the 4 *photo activity types*, the inner circle displays the 13 *photo activity categories*. The solid line, starting from browsing and leading to sharing, illustrates one of the many possible photo activities that can take place. The dotted line describes the workflow of the PhotoWork process (Kirk et al., 2006), which is just one of the possible sequences of use.

As illustrated by Figure 2, the constraints of technologies and resulting practices have slightly changed since the work of Kirk et al. (Kirk et al., 2006). The specific stages and the strict linear workflow of early digital photo activities seem to arise from the lack of, e.g., network connectivity for cameras, the fact that people use personal computers to store and manage collections, etc. New activities that come with the use of new technologies have had an impact on available photo activities: social media platforms have innovated photo sharing, and smart camera phones have changed the

way we think about photography, the frequency and the context in which we capture and share photos.

> "I have grandchildren in Italy, and one of them recently got an iPad, and I got a new washing machine. He […] is crazy about washing machines. So I have a maid […] who makes a photo with her smartphone, and then sends it to me via email, so I can forward the photo to my grandson" - P06 (female; age 69; 7000 photos)

Composite Photo Activities

Our data strongly indicate that the boundary between different photo-activities is not clearly defined. We found that participants engaged in multiple photo activities that follow one another, or between which they alternate. As a consequence, it was difficult to determine what participants consider as a singular photo activity. For example, the activity *sharing* was reported as being a single activity, but in fact the actual sharing of a photo appeared to be part of a chain of activities. In this examples sharing the photo starts with capturing:

> "In certain weather conditions, for example snow, I also take a photo to share on Facebook, like "this is how it was"." - P04 (male; 28; 2000 photos)

> "I take, for example, many photos, which are for Whatsapp – then I send a photo of where I am, what I am looking at or what I am doing. My mother, for example, likes that very much." - P02 (male; age 29; 25.000 photos)

In many occasions the participants did not even realise that sharing is part of a chain, as camera phones with Internet enable faster ways of sharing, compared to the previous workflow that involved getting images from the camera to the computer, and share it over the Internet using a desktop computer. Examples from the participants include the activity of "selecting a photo on a camera phone for sharing on Facebook" (as demonstrated by P01); "sharing a photo directly from the camera phone with Whatsapp

Messenger" (P05); "making a postcard for a friend, using the in-app printing service from Instagram on a smartphone" (P03). Figure 3 illustrates all the actual activities that were explained by the participants as a single activity, but in reality consist of multiple activities.

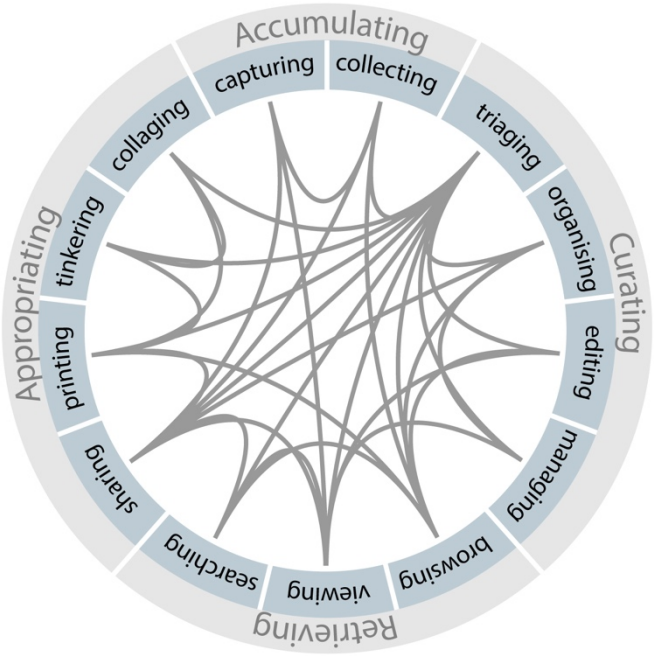

Fig. 3: Illustration of all the photo activity categories that are linked to each other, derived from the description of 171 photo activities. The outer circle displays the 4 *photo activity types*, the inner circle displays the 13 *photo activity categories*. Each line describes connected activities, from the examples given by the participants. Sequences depend on the context, and so there is no predetermined order, starting point or end.

Purpose of Photo Activities

The purposes of the activities could be identified in 163 of the 171 activities. We identified the purposes by analysing the complete description of each photo activity. Eight activities were described in general terms or without context, so the purpose of

these activities was not clear. The findings show that people engage with their photos with the aim to serve a *personal*, *social* or *utilitarian* purpose. The social purpose was the main purpose of using photos, but also individual use of photos, e.g. *reminiscing,* was reported as an important motivator for photo activities. We make here a distinction between individual and utilitarian purposes based on the data: many photo libraries contain a combination of leisure photos as well as practical photos, e.g. photographed receipts and screenshots of online purchases. All purposes resulting in information-driven retrieval, as well as content-independent file management is labelled as having a utilitarian purpose instead of individual, although these purposes are usually individual. The purposes of photo activities, according to the participant data, include the following:

- *Social purpose:* e.g., storytelling, viewing together with others, shared reminiscing
- *Individual purpose*: e.g., individual reminiscing, thinking about past events; browsing for enjoyment; viewing slideshows; creating collages for decoration
- *Utilitarian purpose:* e.g., optimise the organisation as part of hobby or technical interest; searching for specific information

Some examples revealed several photo activities with the motivation to *reminisce*. E.g., P07 described a combination of *editing*, *triaging*, *collecting*, *organising*, and *viewing*:

> "I browse through [my] digital dairy often, to see what I did a few years ago. Sometimes I delete something […]. In there is [described] what I have done […] and how I liked it." - P07 (female; age 66; 40000 photos)

The following example describes individual activities to reach a *social* goal, but also illustrates efforts of self-presentation:

> "I put every now and then something on Facebook […] when I went somewhere together with other people […]. I like […] tagging people, and the comments that follow. But also my background and profile pictures are from my holidays, to show […] that I have been to a nice place" - P04 (male; 28; 2000 photos)

As an example of *storytelling*, P01 described the use of photos to complement a story he shared with friends:

> "It can compliment the conversation, for example the picture of a ring, when I just proposed to my girlfriend and I was talking about it." - P01 (male; age 33; 50000 photos)

Another participant triaged his collection specifically to support telling a story about his holiday:

> "I thought it would be nice to have a selection with me all the time. So I would be able to show it my grandma or my friends. Because I forget many things, I can tell a better story if I have the photos in front of me." - P02 (male; age 29; 25000 photos)

In an example of *reminiscing*, one participant indicated that the location information on his camera phone supported his memory:

> "Sometime I just browse though them […] and review what I have been doing […]. I like the GPS tracker, because now I have all these pins [showing] the places I visit." - P02 (male; age 29; 25.000 photos)

People are oriented towards the purpose of engaging with their photo collection, and many activities were described by the participants that illustrated purpose such as e.g. "sharing an experience", "revitalize friendships", "browsing to fight boredom".

PhotoUse

To make a distinction between the *purposive use* of photographic material and the *work*

of photo accumulating, curating, retrieving and appropriating, we suggest the term *PhotoUse*. In line with the suggestion of Kirk et al. (Kirk et al., 2006) that searching and browsing tools should perhaps be part of other activities within PhotoWork, we believe that designers can benefit if they focus on finding design opportunities to enhance the experience of burdening photo work, by focussing their designs on contributing to one of the purposes of the photo activities.

To be able to use the activities that we found in a constructive way for the design and assessment of tools to support purposive PhotoUse and to emphasise the user experience, we propose an alternative way of visualising the photo activities. By analysing the activities and demonstrations of the 12 participants in our study we were able to conceptualize a model to overview PhotoUse. The model shifts focus away from the tasks and work involved, and their temporal ordering, to the instrumental purpose such work serves, identifying different ways in which subordinate activities relate to each other to serve different needs. The PhotoUse model can be found in Figure 4.

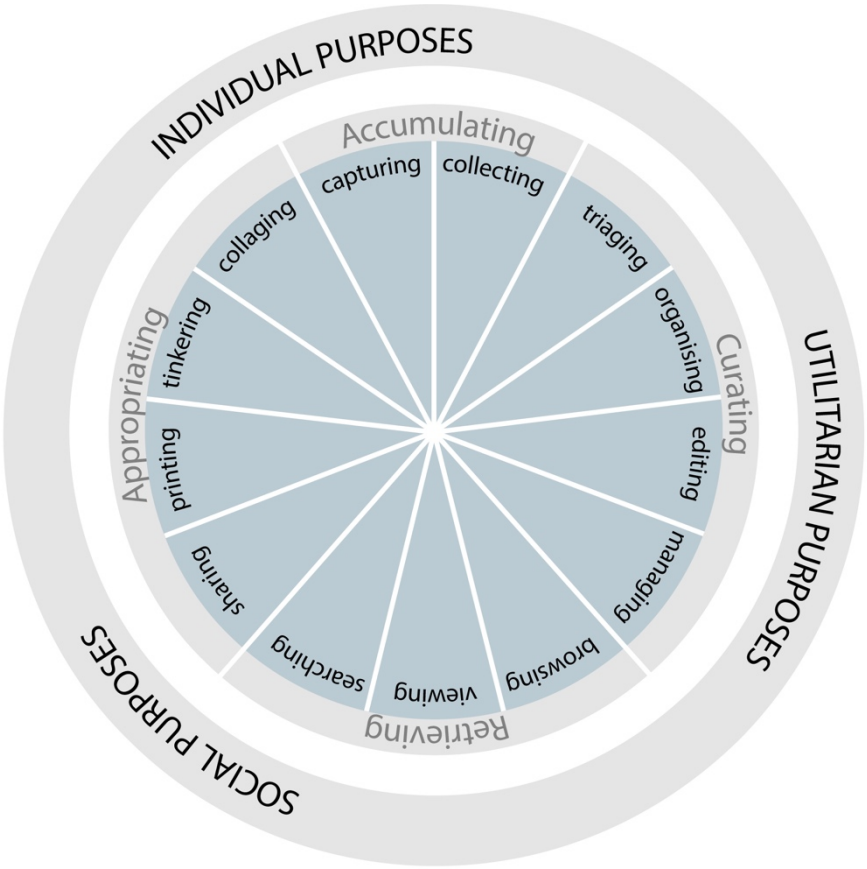

Fig. 4: Model of PhotoUse. The outer circle displays the *social, individual,* and *utilitarian* purposes that motivate the photo activities. The middle circle displays the 4 *photo activity types*, the inner circle displays the 13 *photo activity categories*. All the activity categories join in the centre of the model, together forming the whole of PhotoUse.

The PhotoUse model contains all the activities that together describe PhotoUse. To illustrate our focus on the purposes that motivates behaviour in the model, the purposes are surrounding the photo activities. As example one can think of e.g. capturing a photo with the motivation to future reminiscing, or capturing a photo to simply share an activity via social media.

We believe that the abstracted model can cater for a holistic approach towards photo activities because it illustrates a process without a clear beginning or end. Furthermore, it illustrates the importance of user needs that motivate behaviour. The model might serve designers that are developing solutions for purposive PhotoUse, and

researchers that focus on media supported social activities, such as storytelling and reminiscing. More detailed implications of the PhotoUse model can be found in the next section.

Implications for Design

There are plenty of technological offerings aiming to support capturing, retrieving and sharing. Many technological solutions enable people to reminisce and browse photos, but since those solutions are not specifically designed for mnemonic purposes, they are in many cases less suitable than the participants would like. Most tools are often developed with a focus on productivity, and not on the user experience. We believe, based on the findings, that people want to move freely between different photo activities, in different order. The tools that they use should support and facilitate such freedom. The PhotoUse model can be used in the design process to keep an overview of all the photo activities, thus making sure that challenges (such as retrieving, triaging, searching) are not addressed in isolation, but are considered within the context of a complex chain of activities. In other words, we see opportunities for interactive tools that support the purposes of PhotoUse *while* engaging in photo activities, such as photo *curating*. The following recommendations are intended to contribute to the design and assessment of such tools, with the specific focus on the autobiographical purposes of PhotoUse, either individually (*reminiscing*) or shared (*storytelling*).

Purposive PhotoUse

We encourage designers of especially photo curation tools to emphasize that less enjoyable activities can be part of the PhotoUse activities that people can enjoy, and do not have to be designed and perceived as *tasks that have to be done*. From the interviews we got the notion that participants were overall satisfied with the way they

view and browse their collection, as well as the technologies that they use for capturing, sharing, viewing, and browsing their media. But especially curation does not seem to be intrinsically motivating: all the participants reported that they had curation-related activities in mind that they wanted to do, but that they were postponing, such as organising, printing, sorting, and sharing printed images. One participant explained that she had been determined to do the curation at the start of her retirement 8 years ago, but she still had not done it:

> "My only consolation is that I know hardly anyone who has everything in flawless order." - P06 (female; age 69; 7000 photos)

Another participant felt the need to organise her photos on the computer, every time she saw an organised collection from someone else:

> "A friend of us […] makes printed albums from every event […] one for herself and one for her child. […] And then I am thinking "Wow!" but I will never have the patience for that; there will always be other things that need to be done…" - P05 (female; age 31; 14000 photos)

Other participants also expressed their discontent with the way their collection was organised. We believe that we need to ensure that enjoyment becomes part of curation work, or simply to eliminate curation work by automating it. One opportunity for encouraging curation is our observation that triaging in the final step before sharing is being done frequently, because participants do not consider this as "work", but instead they consider it as gratifying. Especially social activities such as weddings and anniversaries inspire the curation and careful triaging of photos. This implies that it is possible to make curation more enjoyable if the purpose of the activity is clear. Since curation seems to be inevitable and important, tools can pay attention to emphasise for the user what the purpose of the curation activity is, seamlessly integrating into and

contributing to other pleasurable photo activities people engage in such as browsing and reminiscing. The PhotoUse model can be used to find the most promising combinations of burdening activities, enjoyable activities and purpose. A possible design could motivate people to engage in burdening photo tasks, when it contributes to their wellbeing. People generally enjoy the fact that they are building up a life story, and photos can be very empowering for this *narrative identity* (McAdams, 2011).

System-mediated Curation

Supporting curation is important for successful use of the whole photo collection. To help participants think about their curation issues, we asked how they thought about delegating the curation of the collection to an intelligent system that could do the triaging for them. Almost all participants were hesitant, and reported that they would like to keep having influence on their own collection:

> "But […] how would they know what structure I want? Perhaps you need an intake. […]. Some simple things might be nice to have done […] but they can only do that with the items that I have not yet organized […] but they should do it the same way as the rest" - P10 (female; age 34; 3000 photos)

> "It is dangerous to let a program manage your database, as it went wrong when I used iPhoto, and that is not what you want. Because you don't know anymore what is going on." - P02 (male; age 29; 25000 photos)

This provides designers with an interesting challenge, since we found that participants do not automatically accept the support from automated curation systems to do the curation for them, but are also unwilling to do the curation themselves. The balance between automation and control is not a new challenge, see e.g. (Parasuraman, Sheridan, & Wickens, 2000). Even in systems that appear to have been successfully automated – e.g. online shops, helpdesks, and computer-aided learning – people prefer

to have control over their actions. In these cases technology has re-established opportunities for human contact via chat windows, teacher contact, community networks, etc. But human contact is not the only argument for avoiding complete automation: findings from the work of e.g. (Stevens et al., 2003) show that the activity of curating and annotating can also increase the value of the objects. In line with their findings, P03 explained the process of making an album as a way to "frame the memory", which was clearly an enjoyable process that should not be automated. So curation can be *aided* by a semi-automated solution, one in which the user is helped by the system but remains in control. Such systems might be more helpful to the user if they act more in line with the purposes that motivate the curation activities. The PhotoUse model can provide the designer with insight into those purposes.

Context-dependent PhotoUse

The finding that participants want a different subset of their photos for different social situations is in line with the literature on *storytelling*, which occurs when the conversation has been adapted and tailored to a specific listener. Selection of words, topic and ordering sequences are adapted to the recipient of the story (for more elaboration on *recipient design*, please refer to (Sacks, Schegloff, & Jefferson, 1974)). Current tools do not incorporate the flexibility that is needed to support different contexts. In short: people do not have the right picture at hand when they need it, as illustrated by P01:

> "When I […] go to my parents with the goal to view my holiday pictures, I again have to make a selection. That means extra effort because I need to make that selection prior to the visit" - P01 (male; age 33; 50000 photos)

Another comment from several participants illustrates the need for adaptable intelligent systems:

> "I browse for 10 minutes, and then I am distracted by something on the Internet, and then I think of something funny for which I switch back to my photo library, […] and so it goes back and forth." - P10 (female; age 34; 3000 photos)

Due to technological advancement the lifecycle of photos is becoming more complex, and more unpredictable, and users are getting more demanding. Tools that support storytelling need to adapt to the different contexts and demands of the user. We therefore see opportunities for context-dependent selections, to serve as valuable contribution to storytelling.

Collaborative PhotoUse

In agreement with (Kirk et al., 2006) and (Frohlich et al., 2002) we see opportunities to better deal with shared collections, e.g. opportunities for curation solutions when multiple users own a photo collection, which remain relevant and yet unresolved to date. The described activities presented in this research were in many cases done by participants alone, while at the same time many of the activities were done with a social purpose. Although our research setup was geared towards individual photo use, the amount of individual activities with a social purpose provides opportunities to improve the experience of media-supported remote sharing.

Sharing more than a single photo with friends and relatives complicates photo use. Especially the participants that are parents (3 of 12), or grandparents (1 of 12) reported the difficulty of shared responsibility over a family collection. A similar complexity was seen where people depend on the curation skills of others, e.g., children depending on parents for the curation of their childhood:

> "[The children] are sloppier. […] It wouldn't surprise me if [the pictures] are vanished at some point, so that's why I ask them to send them to me." - P11 (male; age 55; 16000 photos)

> "I try to capture the nice events […]. I got [an album] from my parents from my own childhood as well […] so it is nice to have and it is after all a testimonial of your childhood, I want to have that for my daughter as well" - P08 (male; age 40; 300000 photos)

Designing for collaborative PhotoUse provides opportunities for reducing the workload of collection management and is a promising direction for aiding the perceived burden of photo curation, and also provides opportunities for shared remembering.

Discussion

We have argued in favour of a broader consideration of PhotoUse that relates the activities that users engage in with the purpose that motivates them. This perspective arose out of interviews with users that focused on the needs, experiential goals and purposes motivating PhotoUse rather than just the operation of the technology involved. The method of contextual interviews in the homes allowed us to explore the whole collections but also may have biased our study skewed towards homebound media, missing out on nomadic aspects of photo activities, which is upcoming with the use of camera phones, e.g. (Kindberg, Spasojevic, Fleck, & Sellen, 2005; Sarvas & Frohlich, 2011).

Perhaps due to the setup of the study, some of the activities were less represented in the results than one would expect: e.g. capturing is very important, but the activities were focussed on the moment after capturing, and therefore only some of the 171 activities were tagged with *capturing*. Instead participants mentioned using their photos very actively for sharing, browsing, and retrieving. Also, sharing was less often

mentioned as an activity than one would expect. Sharing is a very important aspect of (mobile) digital photography, and the emphasis on the other aspects might be caused by the individual setup of the interview in the home. We did not include the frequency of occurrence of the different activities in the findings, nor did we add the occurrence percentages to the purposes. The goal of our study was to reveal *which* activities occur, and how they relate to each other. We did not want to emphasise certain activities, even though they occur more often in this particular group of participants. Despite the small sample size, we believe that the differences in age, demographics and life stages of the participants provided sufficient variety to consider these results for designing tools to support photo activities. It would be useful to extend our research to include extreme cases in terms of e.g. collection size, age, or familiarization with technology.

Not all the photo activities are serving a higher purpose, since some photo activities are intended to be entertaining in itself. The selected participants in this study were photo enthusiasts, and therefore the enjoyment of photography, editing and organising was present.

The model that we presented in this paper centres around the purpose of user behaviour. We want to stress the difficulty of asking participants about their motivation for behaviour, as they are generally unaware of the underlining motivation for their behaviour. By looking at the motivations and purposes of domestic photography that are described in related literature (e.g. (Sarvas & Frohlich, 2011; van Dijck, 2008), we can relate our findings to the purposes that they found. They made a distinction between the purposes related to a) communication, social bonding, demonstration of cultural membership; b) self-presentation, identity formation; c) preservation and retention of (family) memories (Sarvas & Frohlich, 2011; van Dijck, 2008). The purposes that we defined based on our data include the same array of purposes, although we made a

division between individual and social purposes. In reality the line between a social and an individual purpose is not so well defined, because e.g. self-presentation to a social group is also part of identity formation.

Most of the motivations for photo activities were related to a social endeavour (e.g. sharing; storytelling), using the photos as cues for our autobiographical memory (AM). Bluck et al. (Bluck, Alea, Habermas, & Rubin, 2005) summarized some important functions of AM in our lives, including a social function, a self-preservation function and a directive function. In addition to these functions, an adaptive function has been described by e.g. (Bluck, 2003; Cohen, 1996). In an effort to generalise the purposes that motivate engagement with memory-inducing photos, we related the purpose of photo activities to the earlier mentioned functions of AM. The result can be found in Table 2. Our proposal that the purposes of PhotoUse relate to the functions of AM, supports our finding that people are generally motivated to engage with digital photos to support autobiographical remembering.

PhotoUse purpose	**Functions of AM** (Bluck, 2003)
Social purposes	Social function (e.g. bonding, maintaining relationships)
Individual purposes	Adaptive function (mood regulation) Self function (construction and maintenance of self concept and self history)
Utilitarian purposes	Directive function (making plans for the future based on past experiences)

Table 2: Purposes of PhotoUse related to the functions of AM (Bluck, 2003). Columns are divided in *PhotoUse purposes* and *Functions of AM.*

We are aware that curation tools and applications might exist that are successful, but do not fit our vision. We suggest that the PhotoUse model can be used to model and illustrate the dynamic and flexible set of photo activities that people engage in, inspiring the design of novel technologies, and stimulating research into the use of photographic material to support autobiographical memory reconstruction.

Conclusions

This paper has contributed an investigation into the use of photos for autobiographical purposes. Based on contextual interview data that was analysed qualitatively, we have argued for an alternative perspective concerning photo activities: from the lifecycle of a single photo to the interplay of different photo related activities and the purposes that motivates them. Our presented PhotoUse model can be used to emphasize the complexity and flexibility that is required when designing tools for photo use for individual and shared autobiographical remembering.

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