

# 4Photos: A Collaborative Photo Sharing Experience

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## ABSTRACT

In this paper, we describe the iterative design and user study of “4Photos”, a multi-screen table centrepiece allowing media content to be shared and enjoyed in a social setting. It was our intention to design an object with the purpose to gather qualitative data concerning the social effects of new ways of democratic, serendipitous and playful photo sharing. To facilitate this we used online photo repository content that most often gets experienced in an individual setting. Using 4Photos we positioned this content within a social setting and observed how the presentation of these images enabled new ways of ‘phototalk’ to arise. We describe the design process, the final concept and reflect upon observed practices that emerged from people’s usage of 4Photos. We then present several design implications and discuss future directions for continuation of this research.

## Author Keywords

Information interfaces, Photo sharing, Interaction, Serendipity, Collaboration, Screens, Iterative design.

## ACM Classification Keywords

C.0. Computer Systems Organization: General – Hardware/software interfaces. H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous. H.5.2 [Information Interfaces and Presentation (e.g. HCI)]: User Interfaces - Input devices and strategies (e.g., mouse, touchscreen), User-centered design.

## INTRODUCTION

With the major proliferation of digital photo technologies, we have seen gradual and significant shifts in domestic photographic practices. Digital capture technologies in the form of dedicated devices and mobile phone based capture have opened up photographic capture to a much wider range of the population [5,18]. Other forms of *photoware* [6]

offer new ways for people to store, organise, tag and manipulate photographic content. Digital photo frames and photo printers create different opportunities for the way photographic content is presented in domestic settings. Of significance too are the increased possibilities for sharing our digital photos with others through established CMC channels such as email and perhaps more importantly through the appropriation of online social networking sites such as Facebook. Alongside these shifts, there has been a growing interest among the HCI and design community in emergent practices and values arising from the adoption of these new photographic technologies within domestic settings (see Lindley et al. [13] for an overview). Curiously though, as a number of authors observe, there is a disparity in the focus of this work whereby technologies and behavioural practices around photo displays have been relatively underexplored compared to other aspects of photowork [5,19,20]. Of particular significance to their arguments are concerns with the material properties of photo displays that form the essential components through which social practices, values and meanings are realized. Understanding this relationship between material properties and behavioural practices with respect to photo displays can then provide us with a resource for design. By manipulating the material characteristics of photo display and their setting we should be able to introduce new dynamics into the discussions and other behaviours that happen around these.

With this in mind we present an example of a new form of photo display, *4Photos*, designed to be the centrepiece for a dinner table. In designing for this context, we make a number of design choices intended to introduce different social dynamics into the talk constructed around displayed photos. In particular, through our manipulations of display form factor, interaction access points and mechanisms for sourcing content, we hope to affect some of the subtle control dynamics of phototalk achieved with other forms of photographic presentation (e.g. paper or laptop). In this paper we present a discussion of the 4Photos design and then examine the impact of these factors through behavioural analysis of the system in use.

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### Related work

Before discussing the design of the system, we first wish to build up the context for our arguments with reference to the literature. Work by Chalfen [2] has highlighted ways that domestic photography is a socially engaged practice through which family norms, traditions and values can be expressed and maintained. Such practices are reflected in activities such as the display of photographs in the home and the talk that is performed around photographs. These ideas are seen too in some of the foundational work in HCI and CSCW on photographic practices such as the work of Crabtree et al. [4] and Frohlich [6] on *phototalk* during the collocated sharing of photographs within domestic settings. Crabtree's work is particularly important in demonstrating the interactionally embodied nature of phototalk around printed photographs as revealed through ethnographic observations and analyses of photo sharing practices. Significant to our concerns in this paper is how Crabtree demonstrates the collaborative construction and coordination of phototalk as a practical achievement, realised through the way social groups gather round the photographic representation, the way the physical printouts are oriented to group members, passed around and gestured towards. While this study focused on the paper-based photographic representations predominant at the time, it is nevertheless significant in the ways it relates articulation and interaction work taking to the material properties of the representational artefacts. A key theme from this work is the issue of conversational control and its relationship to the representational artefact. For example, ownership of the physical photograph bestows a prominent role within the phototalk that occurs around it. In part this is about content ownership but also in the timing of photo distribution and physical orientation of the photos to others in the conversation [4].

The material properties of photo display in relation to behavioural practice and values are considered further in [19,20]. Again while this work was conducted with more traditional paper based photographic displays, it draws out key themes useful to our arguments. First is how social meaning is created through the placement of photographs in particular spatial locations around the home (a theme that is also developed in Crabtree's discussion of coordinate displays within the home [3]). Different meaning becomes associated with different household locations. Different locations too affect how photos are available to use in particular social circumstances, shaping the opportunities for use in photo talk – their availability to hand is bound up in the material qualities of their display. Critical to this meaning making with printed photographic materials is that physical display space is a finite resource. If a printed photo occupies a particular location, that location is no longer available for the display of another photo. As a consequence, the choice of photo for a particular location within the home acquires particular significance. Yet such dynamics potentially are shifting with the introduction of

new display technologies. Most commercial digital photo frames, for example, cycle through a selection of images meaning that particular location for display within the home need not be so constrained as by their physical counterparts.

Related to this and also the issues of control discussed above are notions of curatorial control over what is displayed. Durrant et al, among others, argue that curatorial control over placement of photos has traditionally resided with the family member in charge of the photographic technology [2,5,16]. However, with the apparent democratization of domestic photography in terms of capture and online sharing we again see shifting dynamics of curatorial control throughout the rest of the family. While there is increased democratization in display activity here, content of the photos displayed in the home remain closely bound to the owners of the space – namely the immediate family members that reside there. This too affects the dynamics with which such photos come to be used in phototalk on particular social occasions. Authors such as Kim and Zimmerman have highlighted alternative scenarios that may be of interest too [9]. For example, their work considers the scenario of visitors coming into the household. In response to this, they discuss a display concept that enables context sensitive presentation of photographic materials in response to particular visitors leading to potentially new dynamics in phototalk on such occasions of a visit. In this paper we want to explore other ways of shifting curatorial control over content to be more democratic (e.g. among a group of visitors to the home).

Where we have seen interesting innovations in this area of photo display e.g. [9,20] what is curious is the relative lack of exploration in terms of their emergent behavioural properties arising from deployment in real world setting. A notable exception here is the recent work of Leong [11] which explores the use of a digital photo frame within a domestic setting. The particular concern of Leong was with the notions of serendipity arising from the random presentation of multiple images from a domestic photo collection. Leong demonstrated that abdicating choice of photographic presentation in this way, and the uncertainties associated to this, leads to new values and meanings relating to photographic display. We revisit some of these themes of choice abdication, uncertainty and serendipity in the discussion of our own fieldwork later in the paper and in particular how it relates to collaborative photo sharing experiences as opposed to the individual experiences that were the focus of Leong's enquiry.

Generally speaking, where innovation has occurred in the area of photo displays, there is often a strong grounding in the form factor of traditional displays. Many are designed to be positioned on wall, sideboards, shelves and mantelpieces in much the way that traditional photo frames are. The aim here is to augment the traditional with digital capabilities in terms of the way content is sent to be managed and displayed. As such, while location is a strong theme to emerge from the photographic literature little attention is

given over to consideration of alternative locations of display in design. This then is something we aim to address in this paper where we present a concept specifically for a different location, namely the dinner table.

This leads us to consider explorations of tabletop displays for presenting and managing photographs e.g. [1,10,17]. While these have yet to be adopted in any meaningful sense in domestic settings, they at least point to new ways of configuring people around photographic arrangements that can impact on the social context in which phototalk is conducted. This is due to the way the table arranges people around the photo display but also in the way that it opens up access points to all around the table through the use of multi-touch input mechanisms. These factors relate to our design concerns in this paper though we take a somewhat different approach to these issues. Tabletop computing typically treats the whole surface as the focal point for interaction and in this respect the photowork conducted is something that is a focal activity rather than just a component in a social gathering. Our approach, then, is to create a photo display to be situated on a tabletop where it is but one component in the assembly of artefacts making up the social setting, such as a dinner party. That is, it is designed as a tabletop ornament. In this respect, our aims are to exploit the ways a table physically and socially configures people for a particular social gathering but without requiring photowork to become dominant over other aspects of the social occasion and over other artefacts assembled on the table to support these occasions. This approach is in line with arguments about appropriate balancing of interactive and non-interactive aspects of tabletop assemblies [15].

A final line of discussion we want to introduce concerns the sourcing of content and how this potentially relates to shifting dynamics of phototalk. We have already seen how new photowork mechanisms such as online sharing are altering the dynamics of participation in the domestic use of photographic representation [5]. Given this more democratic participation enabled through these mechanisms (e.g., social networking sites such as Facebook or dedicated photo sharing sites such as Flickr), of interest for innovation and behavioural understanding concerns the relationship between these new resources and repositories for photowork and subsequent display behaviour. Indeed how can such democratic participation in online photo sharing be exploited in more democratic photo displays within particular social contexts, as repositories for digital photo displays. That is how can people's online photo resources be combined together for presentation on a photo display to shift dynamics of curatorial control and phototalk.

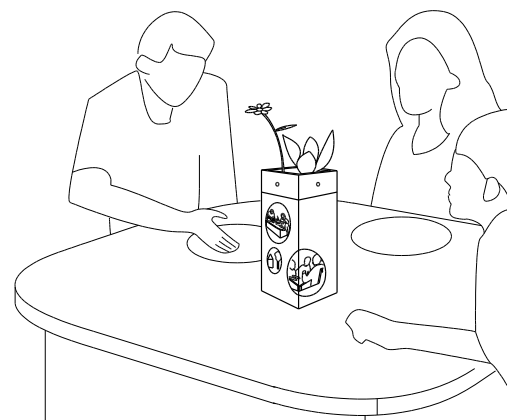
There are of course now commercially available photo display systems that can be linked to online photo sharing and social networking. But we have very little understanding of the behavioural consequences and social values of this. For example, it is yet to be determined whether content designed for a particular online audience

fits neatly to a group defined by a location where the photographic display is placed. Indeed in light of different public private boundaries in different user segments raised by Miller and Edwards [14] with respect to online photosharing practices with sites such as Flickr and Facebook, it is likely that related concerns might be apparent in the linking of photo displays to online photo repositories in social networking sites. This is a question we consider further through our design and fieldwork with 4Photos.

Having discussed some of the factors shaping phototalk and display behaviour such as form factor, interaction access points, location, curatorial control, and mechanisms for sourcing content we now move on to a discussion of the 4Photos concept and ways in which we have manipulated these factors to achieve a more democratic phototalk appropriate to a social gathering.

### DESIGN APPROACH AND CONCEPTS

As mentioned within the previous sections it was our intention to design a research vehicle for exploring photo-viewing activities in social contexts and locations not currently supported by traditional displaying devices. To prevent ourselves from exploring an unlimited amount of different social settings we decided to specifically focus at the social context of having dinner. We were particularly interested in this social context as it offers family and friends to come together for social interaction and presents interesting challenges in relation to social dynamics of talk. To this end, we initially explored a variety of different ideas and concepts. For example, we explored a concept called "media jar" which stores pictures and sound clips captured by mobile devices carried around by family members. This media is triggered on lifting the lid providing a resource for conversation. In a second example concept, the "media vase" mobile phones are docked in the "vase" to create a multi-view synchronised slideshow on the phones' displays. A third related concept we explored was called "photo centrepiece" in which photo viewing takes place on a dedicated device in the middle of the dinner table (see Figure 1).



**Figure 1. The photo centrepiece concept. Apart from presenting media content it could also have a decorative function.**

### Design goals

Through these conceptual explorations we were able to identify and refine particular design goals pertinent to our focal scenario. In light of these goals, it was felt most suitable to pursue the photo centrepiece concept in more detail. We discuss this further below.

#### *Non-obtrusiveness*

The aim was to let the technology not become dominant in the social context, but rather blend in the social dynamics of the moment. Especially given the fact that we focused on the social context of people having dinner, it was important to carefully take family values and dinner rituals in consideration. It was important too not to interfere with the physical assembly of artefacts found in this scenario (e.g. food dishes, plates). In fact, it was our intention to create new possibilities in order to enrich the social experience and bond between people.

#### *Democratic control and participation*

Embedding the artefact in new social contexts required a different approach to the form and interaction design in contrast to traditional photo-displaying products. We wanted the artefact to enable multi-user viewing and participation for family and friends and provide focus on the social enjoyment of the experience. As mentioned before, to offer new ways for democratic participation.

#### *Easy access to new content*

Based on insights from Kirk et al. [10] it can be concluded that people like to use recent content to spark conversation and storytelling. However, this work also reflects issues concerning the high threshold for downloading new content from a capture device. By focusing on an existing media repository, in our case Facebook, we prevented the introduction of yet another object to ‘maintain’ or collect content for.

#### *Random but related*

Using online photo repositories we did not merely want to present content in a similar fashion as pre-arranged on these services. For this reason the object had to stimulate a more serendipitous experience, as also described in the work of Helmes et al. [7] and Leong [11]; wherein serendipity contributes to the quality of the experience. In order to achieve this experience but still maintain the possibility for ‘story telling’, the artefact had to pick random *sets* of related images from any album within the repository.

### DESIGNING 4PHOTOS

Based upon the design goals and early physical explorations we iteratively designed towards a prototype for the photo centrepiece concept. This initial prototype was meant for exploration of the interface and a basic interaction with materials chosen to speed up prototyping rather than focussing on the necessary aesthetics for fit within the domestic environment. It maintained some flexibility to support exploration of different sensors and several interfaces and was robust enough for early user evaluation and allowed us to gather valuable input for the next steps

within our iterative design process. After several design iterations, mainly focused on its interaction features and form, the process led us to the final prototype; “4Photos”. In the following sections we describe the iterative design process from the photo centrepiece towards 4Photos.

### Photo centrepiece

The photo centrepiece prototype was designed to be positioned on a dinner table. A dinner table is designed to naturally configure people to gather for social occasions like dinner and drinks. The aim of the photo centrepiece was to exploit this natural configuration and provide a way for everybody around the table to view and interact with the artefact while maintaining natural gaze and interpersonal awareness (following recommendations of Lindley and Monk [12] whereby displays for photo viewing should afford good interpersonal awareness). To support this, the photo centrepiece prototype was composed of 4 vertical sides, each side framing a small portrait oriented display and an IR distance sensor (see Figure 2).

The artefact is to be placed in the middle of the table as one component in the artefact assembly making up a dinner table – much in the same way one might use a candelabra or flower arrangement as a dinner centrepiece. In this respect it needed to be a light and mobile artefact that would integrate easily with this artefact assembly. With this in mind we adopted a vertical display arrangement, which is more natural for people’s gaze and mutual awareness during the social context of a dinner compared to a horizontal tabletop setup in which people look further down. Bearing in mind the additional criteria for flexible and rapid iteration, the photo centrepiece was developed as shown in Figure 2.

### Interaction mechanisms

We implemented two interaction mechanisms in the prototype. The first used IR proximity sensors. Being positioned on all four sides of the object, these sensors could detect gesture and movement towards the displays from each side. The second interaction mechanism was a rotatable part on top of the prototype, the “head” (see Figure 2).

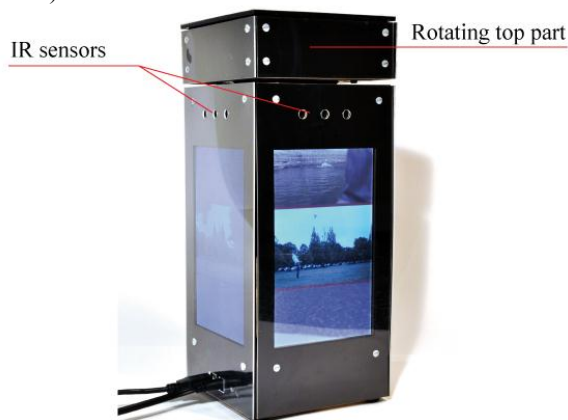
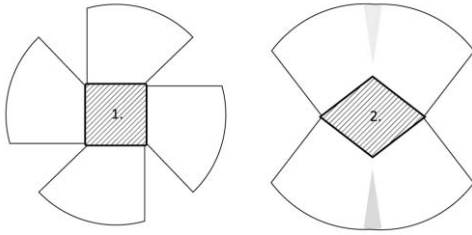


Figure 2. Picture of the photo centrepiece prototype with a rotatable part on top, called the “head”. Approx. size: 12x12x25.



**Figure 3.** Viewing angles of the object, top view 1 shows the original layout of the photo centrepiece. View 2 shows the new layout in which the object is stretched and displays rotated.

#### 4PHOTOS FINAL DESIGN

Through initial testing of the photo centrepiece in tabletop configurations we discovered viewing angles of the displays were not optimal from a number of different directions. The unsymmetrical distribution of the viewing angle, did not lend itself well to typical configurations of people around the dinner table. To overcome this we changed the shape of the prototype (by slightly stretching the original shape) which led to the final form factor of *4Photos*. We also rotated and slightly tilted the displays to create a homogenous viewing field (see Figure 3).

In iterating towards a new prototype we also wanted to create a more suitable aesthetic for the domestic environment, drawing inspiration from other products and concepts fitting within this setting. This resulted in the final form factor prototype displayed in Figure 4.



**Figure 4.** Photo of the *4Photos* prototype with the rearranged displays, domestic aesthetic and rotatable top part.

#### Interface design

We designed the interface of *4Photos* in parallel with the physical form. The next sections describe the iterations and choices we made that lead to the “photostrip interface”.

##### *Iteration 1: Random photos floating around*

The goal of this initial interface was to create a serendipitous photo viewing experience, displaying random photos of people gathered around *4Photos*. These random photos appeared on the sides of the object and started to float around – the photos being different on all four sides to

spark curiosity and conversation amongst users (see Figure 5). Interaction was limited to a zoom function triggered by moving a hand towards the IR sensors (the spinning top part was not used). In an early test, during a family dinner, the object was perceived as very unobtrusive and passive as desired. At the same time though it was considered little more than a picture frame with moving images. One articulated reason being the fact that the random presentation of photos lacked any coherence to facilitate story telling or meaningfulness. A second reason was that the zooming function was not perceived as very useful - the size of all photos on each side of the object increased simultaneously, which simply made it impossible to highlight or talk about one particular photo. Finally, it was evident users wanted control in order to refresh the object’s content.



**Figure 5.** Illustration of the first interface. Random photos move around across the displays

##### *Iteration 2: Moving and horizontal photostrip*

With these issues in mind we introduced several changes. First, in order to allow users to select between content from different people they were able to rotate the head of the device to change the album from which photos were drawn. Second, we changed the zooming function to result in the image, on the side of the triggered IR sensor, to zoom in and push the same image to the other three screens—providing users with a *coordinating* function to highlight and talk about a photo. Third, we introduced an additional feature by maintaining a more structured and meaningful presentation of the photos within a “photostrip”, clustering multiple images from a single person. With this photostrip the four displays create a linked display surface which the photostrip moves around, facilitating storytelling by automatic and continuous cueing [8] (see Figure 6).



**Figure 6.** The photostrip variation of the interface. The photostrip rotates around the 4 sides of the object.

**Iteration 3: Final improvements for testing**

After implementing the previously described features and adding the ‘spinning’ interaction (using the rotating top part), we again tested the object within a similar social setting as during our first user involvement. Based on the results from the user test we decided to maintain the interaction with the photostrip. We tweaked the interface to facilitate a better photo viewing experience. For example, we changed the order of the photos in the photostrip. In the previous iteration, after a spin, the photostrip would start again from the beginning of an album. We observed that people simply did not want to wait each time for 4Photos to go through the same images again before seeing new ones. In the improved version, the photostrip comprises a new set of photos each time a different person is selected creating a more random selection of new images.

Furthermore, as we so far tested with pre-uploaded images; which quite often lead to a lack of content, we decided to source the object with content from Facebook. Apart from having a large collection of available photos from this source, the Facebook API also allowed us to setup a special friends list to allocate the object to the photo repositories of the participants in the evaluation. As mentioned in the beginning of this paper, using Facebook to source content into 4Photos seemed a plausible implementation. Not solely to prevent people from having an additional device to populate with media, but also given the fact that currently Facebook content often gets viewed in an individual setting. We were quite interested as well in the social implications when projecting this content back into a social setting. Amongst other findings we will go into more depth about this topic within the next section.

**USER EVALUATION**

In order to further our understanding of behavioural practices around the device we conducted a series of qualitative tests in real world settings and contexts. The device was deployed on five occasions with different groups who were getting together socially for a meal. We deliberately chose to conduct these tests with different groups where different social relationships might play a role, such as, for example friends, couples, work colleagues, parents and children.

*Group 1:* Colleagues from a research department having a meal together after work. Five males and one female all aged between 20 and 30. Meal is held in the kitchen area at the office.

*Group 2:* Gathering of friends all aged 20-30. Three are males and two females. Two of the group are married and live in a shared house with another of the males. The other two are a couple who are visiting. The meal is in the home of the married couple and third male (see Figure 7).

*Group 3:* Family meal with husband, wife and two young children plus one female visitor. The husband and wife are in their 30s, the children are aged four and six. The visitor is in her 20s. The meal is held at the family home.

*Group 4:* Gathering of three female friends aged 40-50. The daughter and son of the host are also present, aged 12-14. The meal is held at the host’s home.

*Group 5:* Group of student friends aged in their 20s. One female and four males having lunch at their university department.



**Figure 7.** Group 2 gathered around the 4photos at mealtime.

For each occasion, one of the attendees would create a Facebook friends list consisting of those people who would be present at that particular meal. The online albums of these people from this friends list would source the device with photos for that meal. The device would be placed on the dinner table among the other dinner paraphernalia and food. After a brief instruction on the basic interaction mechanisms, the groups would simply get on with their meal. All sessions were video recorded for later analysis.

**Results**

Based on our analysis of the video recordings and guided by the design goals described earlier, we divided the results into six themes. We will illustrate these themes using examples and quotes.

*Display as a conversational resource*

Situating the display within the social context of these social gatherings indeed provided a significant conversational resource for those present.

SY “It’s such a conversation starter.”

The nature of these conversations varied and was dependent upon the make-up of social relationships in the group. We saw examples of shared reminiscing among the close groups of friends and examples where the photographs were used as a means to get-to-know about less well-known members, e.g. the work colleagues on the following conversation snippet:

P “Ah – there’s my daughter” [one of P’s pictures is displayed up]

J “Oh I didn’t realize you had a daughter.”

P “Yes I have two. X is one and a half and Y is three and a half.”

In some sense, these are fairly typical examples of phototalk that might be elicited through other forms of

photographic display and presentation. However, there are subtly different properties and values that arise from the particular form factor and contextual situation in which the object is immersed that seemed to facilitate this. Of particular importance to people was the fact that the photo pool comprised photos from all present and not just the host.

T *“It’s taking it to a different level – it’s about everyone rather than one person’s photo.”*

This shifts the dynamics of control in significant ways, distributing both *responsibility* and *opportunity* for conversational control away from a single person. The photographs offered a means for everyone at certain points to make contributions to the conversation. But it also offered a means for people to *invite* others into the conversation through their questioning about the photographs – such as those who may have been shy and less able to get involved.

#### *Intrusiveness of the display*

It is important to understand that conversation at the table was not simply about the photo content. Often, what started as a particular reference to a photograph would then evolve into its own conversational strand. People could exchange similar experiences and anecdotes with both weak and strong associative ties to the content. Conversations took on their own momentum where attention would shift from looking at the display to more “normal” face-to-face conversational gazes. That is, the device shifted in and out of conversational context throughout the meals, which shows that it supports storytelling. These dynamics are an important consideration for assessing whether the device is intrusive to the setting or shifts dynamics to facilitate the setting. In our observations, there were times when the displayed photos were very much a focal point of conversation – in particular when the phototalk had strong links to the content. But, equally, there were times when the conversation was less closely tied to the displayed photograph – either because of loose initial associative triggers or because of the natural progression of the conversational thread. In these instances the device seemed more unobtrusive and merged within the background.

People’s orientation to the acceptability of this conversational influence was not consistent among groups or the different social contexts. All groups enjoyed conversations arising from the device placement and felt it was a great social facilitator. A couple of participants, though, made reference to the potential of the device to dominate talk. For informal settings and relationships this was not typically an issue but one participant expressed it may be too distracting for a more formal dinner party because of over distraction. Similarly, there were times in the family meal where the children were felt to be paying too much attention to the device and not focusing on meal time. Also valued was how the device created opportunities for conversational topics that would otherwise be unlikely.

SY *“you pick up on random things like fish – you would never talk about fish in normal conversations.”*

As well as using individual photographs as triggers, there were times too when conversations made reference to multiple photographs from one particular photo strip. The clustering of the photos from a single album, then, allowed a more linked storytelling to take place

#### *Coordinating views: physically, verbally, interactionally*

While having different views on the screens provided more opportunity for triggering conversation, there were times too when participants wanted to see the same thing. A number of compensatory behaviours were observed to support this and allow smoother conversation. First, people would adjust their bodily position and gaze to view an adjacent screen. These movements would be in response to conversational or gestural based references to particular photographs on other screens. Typically, the nature of the viewing angles meant that people could only view at most two screens through small adjustments in body orientation (e.g. through leaning over); though occasionally more exaggerated body orientations were used to see additional screens. When bodily adjustments were difficult, participants also engaged in verbal based coordination behaviours.

C *“Oh look at the turtle.”*

CO *“Oh I haven’t got the turtle.”*

C *“The turtle is coming round now.”*

CO *“I’m not on the turtle. I’m on the bubbles.”*

Here, the group work around the “*what you see is what I see*” principle, using verbally mediated pauses in more of a “What you are *about* to see is what I see” principle.

People also used the zoom function to coordinate conversation and shared views. This paused the content momentarily allowing more elaborated stories or closer inspection and reference to specific photographic. But it was also done explicitly to simultaneously push a particular piece of content to all four displays. Typically, the initiator of the conversation, being in front of the relevant display when the triggering photo was visible, performed this action. The timing of the interaction was used to draw attention to a particular photograph. But, it was also conducted in response to “questioning” looks or bodily gestures (e.g. leaning) from other participants.

Another factor that facilitated coordination of conversation across multiple views was that photos shown at any one time were from the same Facebook album. This provided a common contextual relationship for the photos imposed within the particular Facebook profile (e.g. from the same event or holiday). So, even when a conversation referred to a photo not immediately visible to all parties, this was mitigated by the common context of the photostrip.

### *Playing with visibility and invisibility*

While having different images on each screen led to a need for coordination work, there were also playful and humorous behaviours arising from this. For example in Group 2, all the males were arranged on one side of the table with two females on the opposite side. Participant M said *“This is where it pulls in content you didn’t want to show.”* A picture of M then came up and male participant, T, pretended it was showing embarrassing content of M - M’s girlfriend, SY, being seated opposite. The men started teasing M and SY playing on the fact that SY couldn’t see what they are viewing. *“Who’s that you are with M – who’s that girl... Is that a strip joint you are in?”*

In a second example from group 5, we see humour arising from ambiguity of conversational reference in relation to the displayed content. In this example, participant C pointed at the screen facing her, displaying a picture of her brother and said *“Ah that’s my brother. Oh this is a really crap photograph of him really.”* At this point, participant CO bursts out laughing and makes a reference to the image on her own screen saying *“We’ve got Hugh Jackman round here. I should point out that’s not her brother.”*

In these social contexts, then, issues of shared visibility go beyond matters of coordination, highlighting alternative sources of value and meaning making to consider in design.

### *Managing multiple access points*

The ability to interact with the device from all directions, be that spinning the head or the zooming sensors, opened up control to all. In all groups we saw interactions with the device by all present. The device was more inclusive in terms of availability of actions and resources participants had to steer and control the conversation. This differs from photo slideshows viewed on a laptop where affordances of the interaction mechanisms lend themselves to control by individuals in charge of the technology. Within this context of shared interaction and of concern to us here, were the ways access and control was managed through social protocols and also the conditions under which this broke down. With different images being viewed by multiple people at any one time, any change of view had to be negotiated with others for whom the photos were potentially a resource. Cues in conversational content and tone and attentional orientation to or from the device provided important cues in the timing of these interactions such that they could be performed with minimal social disruption. What was striking is how this mutual access and control was often conducted with seemingly minimal effort. But there were times, too, when more explicit attempts were made to negotiate access and control when there was conflict or insufficiently unambiguous cues from others. For example, in Group 2, the men were discussing a photo from a mountain bike-centric photo album. While looking at the photos, one of the women, SY, moved her hand to interact with the device. As she approached the device, her intentions became apparent prompting T to say *‘whoah whoah’* - to stop her moving the photo on, as he wanted the

men to continue looking at the same picture set. A few minutes later when the men appear to have finished their discussion of the bike-related photographs SY asked: *“Can we spin it or are you still...?”* M replied, *“No no I think it’s done now”*. SY responded, *“Are you sure?”*

In most cases, coordination of these multiple access points was successfully achieved and negotiated. Where it did present particular problems was when younger children were present. For example, the two young children in Group 4 were particularly taken with the interaction mechanisms themselves. As a consequence they continually tried to interact with the device with little awareness of its role within the conversation. Consider the following intervention by L, the mother of participant O:

L *“Don’t touch it because we haven’t seen these ones yet... You’ve got to stop!”*

O *“But I like it”*

L *“I know you like doing it but we want to see the photos... Was that a glass of cream or something?”*

K *“It was a coconut.”*

We see here the repair work arising from O’s inappropriate interaction, with references being made to an object that has gone by. So while the parents work around these issues through verbal references, there is some suggestion that more support for this repair work here could have been useful, the ability to bring a photo back that has passed by.

### *Serendipity and goal driven control*

The random aspects of photo presentation provided important user value. People expressed joy and surprise as new photos came up. The uncertainty about which and whose photos would be next created anticipation among participants that was a source of fun. Indeed, a number of the groups compared the interaction to the game of *“spin the bottle* [a truth or dare type game]” and playful purposes.

SY *“I like the way it’s a lottery – who’s it going to land on. You could actually have drinking games with it couldn’t you. Every time it lands on you, you have to take a drink”*

Handing over some control over content to the system provided the kinds of values of serendipitous presentation highlighted in the works of Leong [10]. People were reminded of things they had forgotten:

CO *“It makes me think of all those albums that I forgot were on there.”*

Or things they had forgotten to tell people about:

CO *“It reminds you of things you forgot to tell each other”*

Giving control to the device also allowed the device to remain active during periods when participants were engaged in other conversation threads or activities such as eating. There were times, too, when people were more deliberate and purposeful in their interactions. In contrast to the large playful spins used to achieve random content



selection, slower controlled rotation of the device head was used to select specific people's photos or even a specific photo.

ST *"Can I find the one with the Octopus?"*

At other times, this deliberate control was to create more even distribution of content if it was felt someone's content was represented enough – thereby trying to include him or her in the conversation more. In one episode, SY spun it and it comes up with the same photo again – SY says, *"Oh S you are popular"* – then one of the men on the other side intervened and spun the top again to get new content. A short while later, S's photos appeared again so she nudged the device head to move to the next album.

#### *Facebook content*

In using Facebook photo albums as a photo source, our aims were to provide a low effort way of providing content; exploiting and re-using people's existing photo organisation work. While this was born out, a number of additional issues became apparent about the link with Facebook. One issue of note here is how the device changed the setting of consumption and the potential audience. These issues came back in user behaviour and conversation. For example, there were comments relating to uncertainty about which photos might pop up and if they would be appropriate.

J *"I hope there is nothing embarrassing on there."*

The concerns arise, in part, because control settings placed on photos in Facebook do not always neatly map onto the collocated setting. The device is set up using a host member to whom the other guests are connected to on Facebook. But other members of the collocated setting may not necessarily be connected to each other via Facebook. Therefore, the audience for the photos in the collocated setting is potentially outside the bounds of control settings used for a particular Facebook friends list. These concerns of course are dependent upon the particular relationships that make up the social setting. With the above quote, the social gathering was with work colleagues where identity management may differ from that with well-known friends. We saw these concerns raised, too, in social groups with young children. The father in that Group 4 expressed a similar hope that no *"dodgy"* content would come up. The young children were not Facebook users - it is entirely plausible this would not be an uncommon feature of other social gatherings around the device. While there was little in the way of actual incidents of embarrassment during our observations, what is significant is how people revealed their orientation to these concerns.

A related issue is with interest in particular content presented in the collocated setting. Within Facebook, content is sometimes posted that is of interest to a limited subset of people rather than a more general audience. As a solitary viewing experience, people choose which albums to look at in detail according to interest. However, the dynamics of such use changes in the collocated viewing.

For example, in Group 2, one of the men had an album of mountain biking related photos. While these were of interest to the men, they were not for the women present. SY commented: *"Why does it end up on bike porn?"* Again, of significance is not that this caused any observed problems or frustrations, but how it reveals potential differences in uses and purposes of content in Facebook versus in the collocated setting. As such, Facebook needs to be considered in more subtle ways than simply a low effort way of sourcing content for the device.

At times the relationship between Facebook and the device became two-way. In general, people were happy with the low effort option of utilising existing Facebook albums. However, there were instances where participants put new content on their Facebook accounts specifically because they were going to be using the device. The device and scenario, then, created a new context of usage for Facebook content that shaped Facebook content management. People also spoke of content they would have liked to appear. One couple mentioned they would like to have seen their wedding photos on there as that would have been interesting for the gathered group. These early indicators of preparation activities for these settings suggest more imaginative and creative uses of Facebook might arise with longer-term usage. Of interest here was how people spoke of tagged photographs of themselves or the albums of others as a resource for their photographs. In this sense, people's photograph collections within Facebook were not seen as simply their own immediate collections. Rather Facebook was more of a distributed repository of photographs. As a work around, some participants suggested adding other people to the Facebook "dinner" friends list who were not present but who had relevant photo collections for those attending. For example, T said, *"we should have put Millsy up there."*, making reference to the fact that "Millsy" had lots of good photos of their wedding.

#### **CONCLUSIONS**

In this paper, we described the iterative design and use of 4Photos, a collaborative photosharing device. Our aims with the device were to explore a new scenario of use of photo displays beyond the more traditional "wall and mantle piece" approaches of many current digital photo frames. We focussed on the creation of a table centrepiece that would be used during social gatherings around mealtimes. Within the context of this particular scenario, we wanted to explore a different set of social dynamics around phototalk by manipulating the material properties of the display device. In essence, we wanted to democratise the way that photos could be used in the construction of phototalk as part of a social gathering. We approached this issue in several key ways: making the device visible from multiple directions; by making interactions with the device available from all directions and available to all present at the table; and finally by making curatorial control over the content on the device more of a shared experience. Furthermore we wanted a device that augmented the

mealtime experience and that fitted both with the natural assembly of other artefacts on the table and the natural configuration of people around the table. With these issues in mind in the design of 4Photos, we iterated through several different physical instantiations exploring different key aspects of the form factor. These aspects included the object's aesthetic qualities, its size, mobility and screen orientation. Similarly, we iterated through several implementations of the interface, focusing on key issues such as levels of control (active, passive use), structured vs. random presentation, playfulness, and the extent to which views were coordinated across the device. We further explored implications of sourcing content in different ways, in particular by exploiting photos from Facebook.

We conducted a qualitative user test with five different groups that provided more insight into how 4Photos was used in a variety of different social settings. It was evident that 4Photos functioned as a conversation starter, either because of the enthusiasm it evoked for people to tell about photos or the curiosity of others to find out more about them. It prompted people to find out about each other and exchange stories and also encouraged shared reminiscing among friends and family. Often the content also inspired people to talk about things they would never have talked about before; we observed how very mundane content sparked fun conversations. Apart from functioning as a conversational resource its interaction possibilities enabled a shared responsibility. By distributing its control and content sourcing, 4Photos shifted away from a more individualistic, single person interaction setup. This was further emphasized by the verbal and physical interactions that emerged around the different content on each display leading to alternative sources of value and meaning for the participants (e.g. jokes referencing content about to appear on other people's screens). The serendipitous presentation of content was also a source of fun for participants.

We also started to identify interesting social issues regarding the relationship with Facebook as a source for content. It was apparent that using Facebook raised more issues beyond being a low-effort photo source. There were some interesting differences in the audience and context of use that emerged and that affected the way that 4Photos and Facebook was used.

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