A Study of Cultural Effects on Mobile-Collocated Group Photo Sharing

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ABSTRACT

International and intercultural collaborations provide a unique opportunity to explore cultural differences in the usage and appropriation of a technology. Mobile photo capture and sharing has been growing in popularity in the Western world but nowhere has the practice been as eagerly adopted as in South Korea. In this paper we present an evaluation of a mobile-collocated photo sharing technology probe designed to determine the ways in which photo capture and sharing can effect and enhance face-to-face interaction for pre-existing social groups. We explore the interaction of culture and automatic, real-time photo capture and sharing on groups of friends engaging in a walking tour. We assemble a multicultural research team to better understand our observations and isolate cultural and technological artifacts. We relate our findings to prior work in the area to show that culture can have as much, if not more, impact on group usage of a technology than the technical capabilities of a system.

Categories and Subject Descriptors

H.5.3 [**Group and Organization Interfaces**]: [Synchronous interaction, Collaborative computing]

General Terms

Design

Keywords

mobile, collocated, photography, sharing, intercultural, defamiliarization

1. INTRODUCTION

Cultural background has a strong impact on the way in which users adapt to and appropriate new technology. When designing and studying groupware, culture also effects the way in which it is appropriate to use technology with regards to the rest of the group. For example should the system support only individualistic decision making amongst the group or should it enforce a collective

process. Should the technology make individual interactions transparent to all users and if not, at what resolution should the interactions be controllable by the users. From an evaluation perspective, is it possible to determine the effects of one's own culture on technology use or should observers from an outside culture be included to reveal a deeper understanding. In this paper, we consider the domain of mobile photo capture and sharing to better understand the impacts technology could have on users of different cultural backgrounds.

Photographs are common artifact for recording and sharing experiences. They not only help the photographer remember the experience but can also help the photographer later share the experience with others. Analog photography enforced a temporal break between when a photo was captured and shared due the time and specialty equipment required to develop the photograph. Advances in digital cameras and camera phones has reduced the marginal cost of each photograph to zero, increasing the number and variety of photographs captured. The breaks enforced by analog photography are mitigated by the instant visibility of digital photographs on digital displays, now common for both mobile phones and digital cameras. Despite the configurability of these devices, current camera user interfaces generally enforce a break between photograph capture and viewing, in most cases providing only a small window of time in which to view a photograph after capture before requiring a mode switch. Both screen size limits and a user interface designed for capture and quick review limits the number of people who can conveniently view a photograph at once.

However, the proliferation of mobile devices with cameras, high resolution displays and network connections afford us the opportunity to explore ways of enhancing the ability of groups of individuals to capture and view digital photographs together. Advances in networking technology already make it possible for a person to capture a photograph on their mobile phone and share the photograph with others via email, upload to a website (such as Flickr), MMS or Bluetooth. However, all of these systems force the user to make a decision to share or not share a photo upon capture. While this may be useful and preferred in situations where the audience for the photograph is remote or not part of one's social group, consider situations where users are collocated, engaged in group photo practices, and are unable to easily view the photographs due to screen size limitations.

One system which addresses these concerns is a mobile, group photo capture and sharing system called Mobiphos [5, 15]. Mobiphos was designed to explore the effects of real-time, mobile, collocated photograph capture and sharing on the experiences and communication patterns of existing social groups. Mobiphos provides an effortless interface for sharing photographs as they are

captured by a group of users engaging in a collocated activity. For example, consider a group of friends touring a city, a category of photography referred to by Chalfen as "Camera Recreation [3]." Each person is likely to capture photographs of common touring related subjects such as landmarks or of objects related to personal interests. They may also capture photographs of their friends either as a part of recording the group experience for themselves or at the behest of their friend who wants a particular event recorded.

Mobiphos was first presented and evaluated by Clawson et al. [5]. A combination of quantitative and qualitative techniques were used to study the effect of using a synchronous photo capture and sharing tool in context of a group of friends touring a city. Participants were recruited, given a tour map highlighting local landmarks and instructed in the use of Mobiphos. Researchers then observed participants and gathered notes as the participants followed the path on the map. Researchers also provided technical assistance as necessary. After the tour a focus group was conducted to discuss the experience of using Mobiphos and provide researchers with a chance to clear up ambiguous points in their notes. Clawson et al. presented seven themes of use distilled from the field notes and focus group interviews. These themes focused on understanding:

1. Collective Photography
2. The Situated, Shared Experience
3. Where the Individual Meets the Group
4. Rhythms of Use
5. Collaboration and Competition,
6. Gift Giving, Taste, and Identity
7. Spectrum of Appropriation

In the initial Mobiphos work, Clawson et al. successfully identified collocated–synchronous photo capture and sharing as a significantly under–explored domain of digital photography and networked visual communication. They presented the design of a novel photo capture and sharing application that supported collocated–synchronous photographic practices and identified seven themes of use.

Patel et al. followed up the initial study and provided further analysis of the Mobiphos system [15]. They explored the evolution of the Mobiphos design from initial prototypes to the pilot versions of the system and the final version of Mobiphos which was studied by Clawson et al. [5]. Patel et al. analyzed the data logged by the Mobiphos device, examined photographs captured by the users, and reported on observations of interactions between group members and Mobiphos to determine the impacts of various design choices on the effect of Mobiphos on participants interactions with each other, the system, and the environment.

In this paper we present a subsequent evaluation of Mobiphos to address concerns that arose from the initial work. In the original study, the participants were not heavy users of existing mobile-to-mobile sharing technologies such as Bluetooth or MMS. This may have led to a comparison of the Mobiphos way of sharing photographs to no sharing at all as opposed to comparing Mobiphos to existing technologies. The evaluation and analysis presented in this paper were performed in Seoul, Korea with a mix of Korean and American teenagers. Our preliminary survey of participants showed that almost all of them made heavy use of existing technologies designed to support mobile-to-mobile sharing of photographs. The composition of the research team was expanded to include Korean researchers. By including Korean researchers we were also able to expand the study to examine participants who were not comfortable speaking English.

We also explore an implementation detail which may have had an adverse effect on group dynamics. Prior evaluations of Mobiphos required the presence of a central WiFi router, carried by a researcher, so that the mobile devices used could communicate over a WiFi network. In this evaluation we remove the need for this central point by creating Ad-Hoc connections between all devices. This allows the group to continue sharing as long as they are near each other. Additionally, this allows all of the researchers to remain on the periphery of the group and lessens possible interference on the group dynamic.

2. RELATED WORK

International and intercultural collaborations provide a unique opportunity to explore cultural differences in the usage and appropriation of technology. This is due in some part to the sense of defamiliarization felt by the non-native researchers when they explore familiar devices through the defamiliarizing lens of a different culture [2]. Several research teams have started exploring the impact of cultural background and orientation on tool usage and appropriation. For example, Vatrapu et al. specifically examined the impact of culturally appropriated affordances in computer supported collaborative learning environments [23]. Irani et al. have chosen to examine this phenomenon through the lens of "post-colonialism." In their early work on this subject they examine the dynamics of culture and advocate an approach to investigating cultural differences "that strives to understand how relationships, technological objects and knowledge practices of everyday life arise as contingent, processual and dynamic materializations whose boundaries are not set in advance" [10]. We agree with this approach to studying cultural aspects of technology adoption though we break with their later work in this space that advances an HCI4D agenda which is outside the scope of this project [9].

Cultural theorists have distinguished several dimensions along which cultures vary that might influence technology use. The individualism-collectivism dimension reflects cultural tendencies toward acting as individuals versus acting as members of a group [7, 22]. Individualist, typically Western, societies emphasize individual initiative and independence. People are expected to look after themselves and to put their own interests first. Collectivistic, typically Eastern, societies stress group solidarity and collective identity. People in collectivistic societies demonstrate an inclination toward a tightly-knit social framework where people expect their companions to look out for their welfare and where personal goals are subordinated to those of the group. The low- versus high-context dimension reflects the amount of contextual information required for communication [6]. Low context, typically Western, cultures communicate primarily through verbal information. High context, typically Eastern, cultures rely heavily on situational information (e.g., nonverbal behavior, relationship between participants) to facilitate understanding.

It has been well documented that people with different cultural backgrounds tend to use collaboration technologies differently [4, 11, 14, 20, 21]. Setlock et al. found that pairs of Chinese individuals communicate more face-to-face than via IM, whereas American pairs communicated an equal ammount in both media. Not only that but Chinese participants used IM differently from Americans in terms of conversational content, efficiency, and task performance [20]. Massey et al. examined differences in satisfaction with asynchronous communication across individualist and collectivist cultures. Lack of prompt feedback and reduced contextual cues were associated with lower satisfaction levels among participants having a collectivist background. Massey highlighted the importance of continuous feedback in high-context cultures [14]. Choi et al. [4] found that Asian (high context)

Figure 1: This Mobiphos screenshot shows the interface in mid-animation. Thumbnails are arranged along the left and bottom of the display and the viewfinder is shown in the top-right corner. Colored borders along the thumbnail indicate the user who captured the photograph.
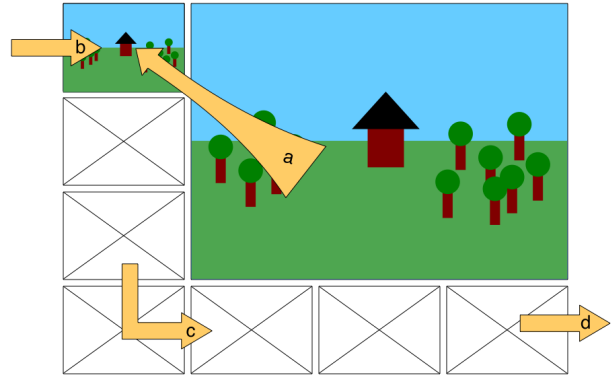

Figure 2: The viewfinder composes the top-right of the display. A captured photograph animates into the top-left corner (a). When an image arrives from another user, it is also placed in the top-left corner (b). Regardless of the image source the timeline animates, sliding around the bottom-left corner (c) and the oldest image leaves the screen (d).

participants relied on visual elements in the interface to a mobile text service whereas Finnish (low context) participants did not. Teng et al. examine cultural effects of technology use in the workplace [21], however there have been few studies that have examined collaborative technology use in a field setting.

Inspired to take a reflective design approach [19] to improving the tool, we decided to deploy Mobiphos in the hopes that by defamiliarizing the use of the system, the research team could uncover a set of values built into the tool that impact usage. In this paper, we explore cultural differences in the use of a mobile photo capture and sharing system. Mobile photo capture and sharing has been growing in popularity in the Western world but nowhere has the practice been as eagerly adopted as in Korea and Japan [24]. Recent studies have shown how mobile photo sharing can support informal communication, group awareness, and other social group functions (e.g., [5, 15, 17, 18]). However, these studies have been conducted in Western societies. In a world that is becoming increasingly globalized, it is important to understand whether Western patterns of group socialization and communication generalize across cultures.

3. MOBIPHOS APPLICATION

Mobiphos was first presented by Clawson et al. [5] with a more detailed exploration of design and implementation presented by Patel et al. [15]. Mobiphos is an application designed to aid photograph capture and sharing for collocated users from pre-existing social groups, such as friends participating in social activities. Mobiphos implements some of the standard features found in all digital cameras such as a viewfinder, photo capture and the ability to browse thumbnails and view photos in full size. As with standard digital cameras, photographs are captured by pressing a button along the top, right-hand side of the device. Mobiphos differs from standard digital cameras in that any photograph captured by a member of the group is automatically shared, in real-time, with all other members over a wireless network. Due to this real-time sharing, Mobiphos combines the viewfinder and thumbnail review modes into a single screen, thus allowing a user to easily capture their own photographs while monitoring the activity of the rest of the group. The thumbnails of all group members are combined into a single timeline which is wrapped around the viewfinder (Figures 1 and 2).

As photographs from other users arrive, they are animated into the top-left corner of the screen. Each photograph is framed in a particular color which is unique to the user who captured the photograph. Older thumbnails are animated down the left edge and to the right on the bottom edge of the screen, exiting the view from the bottom-right corner. When a user captures a photograph it is also animated to the top-left corner of the screen followed by the same animation for older thumbnails. A 4-way directional keypad is provided to aid in reviewing photographs which have animated off screen. Users can press up or left to move the timeline backwards and access older photographs, pressing down or right animates the timeline forwards to more recent photographs. By pressing and holding a button, the user can cause the animation to gain speed, releasing the button causes a swift decrease in speed and the timeline snaps to the closest picture in the direction of movement. Thus quick presses allows the user to move one photograph at a time. A button directly above the directional keypad enables the user to move swiftly to the beginning of the timeline with a single press. Thumbnails are enlarged by direct interaction with the touchscreen and tapping on the thumbnail. The thumbnail animates to occupy the area of the viewfinder, leaving a gray rectangle with a white frame in its timeline location. The directional buttons now allow the user to navigate through the thumbnails in a zoomed in view. To send the thumbnail back to its spot in the timeline the user simply taps the photograph again.

3.1 Implementation Changes

Prior literature on Mobiphos explains the implementation of Mobiphos in great detail [15]. Here, for transparency, we present and explain the need for a technological change to the implementation of Mobiphos. All versions of Mobiphos make use of a WiFi network to allow the devices to share photographs. In prior versions, this connection between devices was made possible by a battery-powered router, which was carried by one of the researchers. This central access point meant that the sharing of photographs between any two participants could only occur when both participants were within range of the researcher carrying the router. Mobiphos is capable of dealing with network unavailability by simply queueing information about when a photograph was not successfully sent to group members and then sending that

photograph when the group members next become available. It is possible that this centralized networking approach may have caused an artificial cohesion amongst the group members. To make use of Mobiphos's sharing features users had to actively monitor and react to the researcher's position.

In an effort to address this concern, before undertaking the current evaluation of Mobiphos, new firmware was used for the WiFi cards in each of the Mobiphos devices that allowed for Ad-Hoc network connections. By changing the architecture of the network we removed the need for every group member of the group to be near a central point. Instead, Ad-Hoc sharing allows group members to split into subgroups and still maintain connectivity.

4. METHOD

In this study, we use a combination of quantitative and qualitative techniques to understand the effect real-time sharing can have on small social groups engaged in a photo capture activity. Specifically, we are looking at a group of friends who are engaged in a self-guided walking tour. Our participants are recruited from preexisting social groups. Each group of participants engage in identical walking tours of a common tourist destination while using Mobiphos enabled devices to capture and share photographs in place of traditional digital cameras. Due to the differences in language preference of our participants the research team was composed of researchers fluent in Korean or American English.

4.1 Research Team

The research team was composed of six members, four Korean researchers and two American researchers. All four of the Korean researchers work in an industrial research lab that actively conducts mobile HCI research. There were two senior Korean researchers (each with seven years of experience) and two junior Korean researchers who had two years of experience each. All four researchers have conducted research studies in Asia but have not been primary researchers involved in collaborations with Americans. Their focus is on understanding the current use of mobile devices and guiding future development of commercial products. All four Korean researchers have some level of English proficiency. The two American researchers, both from an academic setting, have six years of mobile HCI research each. The American researchers do not speak or understand any Korean but do have prior experience working with Korean researchers in America.

4.2 Participants

There were a total of fourteen participants, six males and eight females who were recruited for the study. They were divided into four groups (A, B, C, D), composed of three or four people each. Each group of participants was recruited such that there were preexisting social connections between the participants. The age of the participants ranged from 15-19 with an average age of 16.28 years and a less than one year age difference within a group. Two of the groups were mixed gender (C & D), one group was all males (A) and one group was all females (B). Three of the groups were comprised of Korean students (A, B, C) and one group was of American students (D) who were studying at an English medium school in Korea due to their families having moved there. The groups of Korean students primarily spoke Korean and the group of American students spoke American English.

All of our participants owned digital cameras or camera phones and regularly used their phones to capture photographs. All but one participant used their camera phone to send photographs directly to other camera phones. The one participant who said he did not do this was in the group of American students and cited difficulty in composing messages in Korean as his reason for not sharing over MMS. When asked about how they send photographs between devices, 13 participants responded that they used MMS and 5 responded using Bluetooth. All participants regularly used their phone to share photographs through a centralized photo sharing service. The Korean participants cited Cyworld (8 participants) or Naver (3 participants), both popular Korean websites, as their service of choice for sharing photographs from a mobile phone to the web. The American participants cited many services including Facebook, MySpace, Photobucket, Flickr, etc.

4.3 Procedure

The design of this study was patterned on the previous work by Clawson et al. [5]. Unlike that study which did not take place in an area traditionally visited by tourists, the current study was conducted in the Bukchon historic area which is located between the Gyeongbokgung and Changdeokgung palaces in downtown Seoul. This area between two of the five "Grand Palaces" was built during the Joseon Dynasty and is considered a highly touristed area.

4.3.1 Pre-Tour: Surveys and Training

Participants began by completing individual surveys designed to elicit information about their current use of digital cameras, camera phones and photograph sharing services. To understand the ways in which Mobiphos could be used in their day-to-day activities we also ask participants to describe recent experiences in which they were capturing and sharing photos in a face-to-face setting. Then, depending on the language preference of the participants, the researchers instructed the participants on how to use the Mobiphos application. All features were described and tested by the participants. Once the participants were comfortable with using Mobiphos the group was given a tour map of the surrounding area. A walking path was highlighted on this map. This path was originally determined by the researchers as one that would not result in tiredness and also would cover "Photo Spots" highlighted by the local tourism board as good locations for capturing photographs. These photo spots commonly involved a nice landscape view of parts of the city or were near examples of historical building styles of the city. After completing the survey and explaining the map to the participants, the participants were given a chance to ask questions for clarification. Once these questions were answered the tour began.

4.3.2 The Tour

The researchers embedded themselves with the group of participants at the beginning of the tour and stayed with them throughout. One of the Korean researchers stayed ahead of the group to help pace the tour and to ensure that it stayed on schedule. Depending on the primary language of the participants two of the American or Korean researchers followed behind the group to capture notes on system use as well as conversation amongst the participants. The participants could move rather rapidly and because they all knew each other already the conversations were quite fluid. Two researchers was a necessity to gather field notes that could provide adequate coverage of the group conversation, activity with each other, and interaction with Mobiphos. The other researchers followed from a distance and made observations regarding the overall group dynamics, noting when groups split and merged, as well as recording video of the participants for further analysis and as a way to tie shorthand notes to in-field activities. The walking tour was designed to last between 45-60 minutes.

4.3.3 Post-Tour

After the tour, to determine the usefulness of Mobiphos' automated sharing, participants engaged in an individual, three part, photo sorting activity. The first step was for the participants to look at all of the photographs captured by the group and decide which ones were their favorite. In part two, participants were shown just their favorite photographs and asked to pick the ones that they thought they had captured. Finally, participants were shown all of the photographs they had captured and asked to pick which ones they would share through existing technologies such as MMS, Bluetooth or online photo sharing websites had the sharing enabled by Mobiphos not been available. The task was designed to elicit the mismatch, if any, between the photographs people think their friends would want and those that they actually do want.

The last step of the in-field evaluation was to conduct a focus group with the participants. While the participants were engaged in the photo sorting activity before the focus group began, all of the researchers gathered and quickly made a list of questions from the tour that they would like covered during the focus group. These tour-specific questions were asked in the focus group as well as a predetermined set of questions that were asked to each group of participants.

The researchers in charge of conducting the focus group were chosen based on the language preference of the participants. Each focus group started with a set of common, open-ended questions. Participants were asked questions regarding existing practices of sharing photographs when collocated and were then asked to compare these practices with their experience using the Mobiphos application. Depending on answers, researchers asked follow-up questions to uncover more detail as necessary. Before concluding, participants were also asked to give comments on the overall usability and features of the Mobiphos system.

At the end of each day, all of the researchers worked together to compare field notes, examine video evidence, and explore a timeline of the photographs captured by the participants in an effort to create a cohesive story of the day's tour. This was done for two reasons: first, this allowed researchers to determine if there were any points in their notes where they may have missed an event. This was common when groups spread apart and researchers who were noting conversational topics missed parts of the conversation. Second, this allowed the American researchers to clarify any behavior they noticed and determine if the behavior was a cultural norm or if it was possibly a unique outcome of using the system. Many of the observations of the American researchers were not noted by the Korean researchers as they were not seen as significant and some were clarified by adding a translation of the conversation during the event.

4.3.4 Photograph Categorization

After all of the tours were completed we performed an analysis and categorization of the photographs captured by participants as a way of understanding what level of engagement the participants had with the tour experience. Our choice of categories is based on the nature of the task, the nature of photographs commonly taken with camera phones, and prior work [1, 3, 8, 12, 13, 15]. The five categories are:

1. **Training:** Photographs captured by participants during the Mobiphos training phase of the experiment.
2. **Tourist:** Photographs captured at points on the map described as good places to capture photos. Also, photographs of the traditional architecture, as that was the main draw of the tourist area.
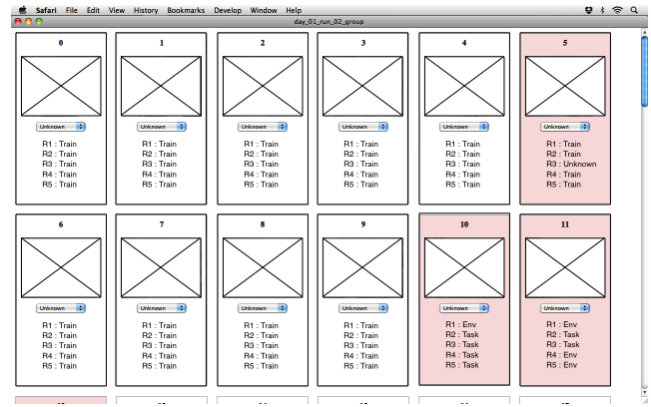

Figure 3: The photo categorization user interface. Each main box shows the ID of the image, the image, a drop-down menu to choose a category and, optionally, the category choice of the other researchers.

3. **Environment:** Photographs of the environment that did not fit the criteria of a Tourist photograph.
4. **People:** Photographs that are taken of people such as self-photography, photography of friends, researchers or by-standers.
5. **Unknown *or* Accidental:** Photographs where the subject was unidentifiable, for example if the photo was too blurry. This category also included accidental photographs.

Five of the researchers, two America and three Korean, performed this categorization activity. The categorization was performed in a two-stage process using a simple web-based interface. First, for each tour, a researcher would go to a webpage which was tiled with the photos captured by the participants during the tour. Below each photo was a drop-down menu which allowed the researcher to select a single category from the list above. Each researcher was asked to choose the category they felt was best given the definitions above. After all of the researchers had completed this individual categorization the results were combined into a single interface. Again, the photographs were tiled with a single drop-down menu below with the addition of all of the individual categorization of each researcher. Photographs were highlighted to indicate the degree of disagreement between the researchers, photographs which were categorized the same by all researchers were shown but not considered further. For each photograph that had a disagreement the researchers discussed their viewpoints and came to a conclusion regarding the final categorization of the photograph. An image of the categorization user interface is shown in Figure 3. The only difference between this UI and the one used for the individual categorization activity is the presence of the other researchers labels.

5. RESULTS

In this section we discuss the results of the study. We start with a categorization of the content of photographs and insights provided by the post tour photo sorting task. We then discuss comparable and contrasting behavior of our participants in relation to prior work. We follow with a discussion of interaction effects between cultural differences and the Mobiphos design on group dynamics. We then discuss participant concerns with automatic sharing and the impact of modifications to the networking infrastructure.

5.1 Subject of Photography

The four groups (fourteen participants) captured a total of 1,124 photographs. An analysis of the photographs was performed to determine the main content of the photograph which we use as a method for judging the engagement level of the participants with different parts of the tour experience. While this exercise was primarily performed to provide insight into the engagement of the users with the tour experience, another goal was to see if there was a significant difference between how the Korean researchers and American researchers perceived each photograph. Of the 1,124 photographs, 54% of photographs were categorized identically by all researchers in the individual categorization exercise. Of the mismatches, 71% involved only a single researcher choosing a different category from the rest of the group. In these situations the researchers sided with the majority unless there was an obvious mistake or gross misunderstanding amongst the researchers. Only 13.12% of photographs required a discussion to decide upon a category. We believe that our very well defined categories may have negated any possible cultural effect when assigning photographs a category. A more open coding scheme may be beneficial for future research to study cultural interpretation of photographs.

For the rest of this section, we will discount the photographs that were in the Unknown or Accidental category and those captured during the Training phase. This brings our total number of photographs down to 997 photographs. However, the number of photographs is not evenly distributed across groups. Group D, the American students studying in Korea, captured a disproportionally large number, 421 of the 997, of photographs. On average the remaining groups captured 192 (SD=88.02) photographs per group. Table 1 shows the categorization of the identifiable, non-training photographs.

Group	Tourist	Environment	People
A	1.94	23.30	74.76
B	12.19	36.20	51.61
C	12.89	35.05	52.06
D	11.16	69.60	19.24

Table 1: Percent of group photographs by category

5.1.1 Tourist Photographs

This category includes photographs which were taken at the spots designated on the map as good places for capturing photographs (Figure 4). Additionally, given that the area for the tour was considered as an area specializing in traditional architecture we also include photographs captured of the type of architecture espoused by the tourist map. On average, 9.54% (SD=5.12%) of the photographs captured by each group were tourist photographs. We consider Group A to be an outlier in this category of photos, with only 1.94% of photographs captured falling into the Tourist category.

5.1.2 Environment Photographs

Photographs of the environment accounted for $41.04\%(SD = 19.91\%)$ of the photographs captured by each group. Photographs in this category included objects of interest to participants (Figure 5) which were not part of the historical setting of the touring area. For example, many photographs were captured of non-historical buildings, flora, interesting signs and storefronts as well as objects captured to contribute to ongoing conversations. For example, in Group C, a participant captured Korean letters to spell out "Foolish

Figure 4: Photograph showing two rows of traditional architecture.

X" where "X" is the name of another participant. An outlier in this category was Group D, with 69.60% of their photographs belonging to the Environment category. Group D rarely stayed together and was continually splitting and merging to capture many different parts of the environment. This is in strong contrast to the other groups which stayed together as a cohesive unit during most of the experiment making decisions on what to capture as a group. This may have created a social filter which reduced the overall number of photos.

Figure 5: Photograph of a bench end. This bench was captured by multiple members of every group.

5.1.3 People Photographs

Photographs of people accounted for 49.42% (SD=22.84%) of the photographs captured by each group. This category has two outliers, Groups A and D. Photographs of people comprised 74.76% of the photographs captured by Group A. In the post-tour interviews, it was discovered that the participants in Group A had decided to play a game which involved getting as many pictures with random strangers as possible. The act of asking a random stranger for a photograph was what is referred to as a "dare" in the USA.

Only 19.24% of the photographs captured by Group D were of people. We believe that the low percentage of photographs of each other, along with the rather high percentage of photographs of the environment, is an effect of the group dynamic of Group D. By constantly moving around and having individual photograph capturing goals, participants were not able to coordinate photographs that involved multiple participants. The majority of photographs showing people other than the capturer (i.e. self-photography) in Group D are taken either at the beginning and ending, when the researchers were still leading the participants.

The subjects of the people photographs captured by our participants fell into three main sub-categories: (1) Posed Photographs, (2) Accented Photographs and (3) Blocked Photographs. Posed photographs are, as expected, an attempt to create a particular scene through group negotiation and positioning. Posed photographs occurred at the "Photo Spots" as well as with objects of interest to the participants (Figure 6). In some cases a single participant may have wanted a particular photograph of them taken and would ask the other group members to capture the photograph after getting into the pose. On some occasions this photograph was taken multiple times if the first capture was not what the subject of the photograph wanted it to be. This behavior was facilitated by the automatic sharing of Mobiphos in that the subject of the photograph did not have to leave the pose to see how they were captured but could instead view the photograph immediately on their own device and request another capture if they did not like the photograph.

Figure 6: Photograph of participant standing in front of a car he liked. The participant requested for this pose to be captured. (Face blurred)

Accented photographs are photographs where a participants used their hands or an item to slightly cover their face in some way. The most prominent use of accenting was seen in our female participants (Figure 7). This accenting varied from raising a few fingers in front of the face to fully covering a portion of the face, most commonly the mouth. Females used accenting occasionally when capturing a photograph of themselves, however they always used or attempted to use accenting when others captured photographs of them. Males were unlikely to accent their face and instead focused on capturing "funny pictures" or those with an un-accented face.

Blocked photographs were most commonly seen in situations where the photograph capturer was male and the subject, or one of the subjects, was female. Group C had the highest number of

Figure 7: Female participant creating a V-shape with fingers to accent her face.

blocked shots. In this group, the male participants tried to capture photographs of the female participants' faces, while the female participants attempted to block, with an item, their hands or by looking away (Figure 8). Group A, an all male group, spent the majority of their time playing a "Rock, Paper, Scissors" style game where the loser would have to approach girls on the street and get them to take a photograph with them. In all of these photographs, the girls who posed for the photograph would block much of their face. This blocking behavior is distinct from accenting behavior in that there was a strong focus on not allowing an part of the face to be captured and it the lacked the same playfulness as accenting.

Figure 8: Female participant blocking her face with the tour map.

5.2 Photo Sorting Results

The photo sorting task was designed to quantify the usefulness of the automatic sharing feature of Mobiphos. Two key figures are derived from the photo sorting task. First, by comparing the photographs marked as favorites when considering the entire set of photographs captured by the group and the photos chosen by each participant to share with the group in lieu of Mobiphos'

automatic sharing, we found that of the favorite photos, on average, 16.35% (SD=4.98%) of favorites would not have been made available through traditional photograph sharing systems. Looking at the situation from the viewpoint of the sharer we found that of the photographs chosen to be shared through traditional means, on average, 24.97% (SD=13.58%) of the photographs were not marked as favorites by the other participants.

Prior work also showed that participants are not always adept at choosing photographs that will be of interest to the rest of the group, despite belonging to a peer group. In prior work, it was found that the mismatch was caused primarily by a lack of understanding of which photographs were meaningful to group members rather than an a deliberate filtering of potentially embarrassing photographs. While we found similar results, we also found that there was in fact a deliberate attempt at filtering. This will be discussed in Section 5.4.1.

5.3   Rhythms of Use

In prior evaluations of Mobiphos, the rhythms of group movements were found to have a common pattern [5]. On a smaller-scale as each group approached a landmark, individuals split away from the group and as individuals capture photographs of the landmark from different angles. As each member finished their individual capture activity, they would start to rejoin the rest of the group. The group would then browse photographs captured as they navigated to the next landmark. Our change to an Ad-Hoc network was in part inspired by this behavior, we hypothesized that the limitation of the router based networked forced users who wished to split up to have distinct capture and browsing times. While each participant was able to browse on their own phones, this mental mode switching was not that different from switching between capture and playback mode on a standard digital camera and was not the intended use case for Mobiphos.

However, we were not able to fully test this idea as our Korean participants rarely split away from the group. Only in groups of four participants did we see any separation and in those cases only into smaller subgroups of two. Additionally, it was rare to see any single participant form their own objectives outside of the group. Groups A, B & C, the Korean participants, interleaved capture and browsing activities on a smaller timescale than in prior work. The browsing feature was most commonly used when coordinating a posed photograph, the goal being to determine if a "good" photograph was captured. Other uses of browsing were noticed when engaging in self-photography. The only group of participants that exhibited similar behavior, to groups in prior evaluations, was the group of American students, Group D. However, despite the splitting and merging of Group D, little time was spent browsing in the field, instead participants in Group D formed very individualistic photo capturing goals and only browsed photographs when a group member explicitly requested they do so.

Despite the differences in micro-rhythms, there was a strong correlation between evaluations of the macro-rhythm observed in prior evaluations. Over the course of the tour, participants became more engaged with the technology. What is notable is the way in which the technology is used. When navigating, activity was mainly geared towards staging and capturing photographs with minimal browsing. As the tour finished and the group returned to the starting point, activity switched to browsing and discussion around the photographs.

5.4   Designing for the Culture

5.4.1   Effects of Automatic Sharing

In both the prior evaluations and our evaluation, some of the participants had an issue with the automatic sharing. In prior evaluations, participants who were concerned about automatic sharing had reservations about how some of the photographs portrayed their ability to capture "good" photographs. For our Korean participants, the primary reason for not enjoying the automatic sharing was in regards to capturing photographs of themselves. The post tour focus group revealed that this concern was due to how automatic sharing interferes with existing practices. Participants stated that when using standard digital cameras or camera phones they would take multiple photographs of themselves and choose from those photographs a single one to share with friends or upload to a blog. While American participants were concerned about their identity as a photographer, our Korean participants were more concerned with presentation of their physical self.

A common view on automatic sharing between our evaluations and prior evaluations was in regards to the recipients of the images. In both cases, participants commented that automated sharing within the group of friends was acceptable, however automated sharing to a remote third parties would not be good. Participants indicated that the shared nature of the touring experience made it more appropriate to automatically share photographs in the group than with people who were not part of the group. This sentiment was held to regardless of the social tie, friends, acquaintances or strangers, of the third party in question; a mechanism for filtering photographs was a requirement.

5.4.2   Effects of Modified Network Infrastructure

One concern of the prior research was the use of a network which required a central point, in this case a WiFi router, of connection for all of the Mobiphos devices to enable wireless sharing. This created a non-intuitive technical limitation for participants, despite being near each other if they were too far from the central point the wireless sharing would not work. Also, requiring that a researcher remains in the middle of the group to maintain the best connectivity may have interfered with the group dynamic. The group is forced to consider the presence of the researcher to make use of Mobiphos for its intended purposes. Despite these limitations, users, in prior work, would still separate from the researcher with the router even though it meant losing wireless connection with the rest of the group. We believe that the loss of wireless connection was mitigated by the networking software of Mobiphos which was designed to be robust to dropped connections.

To remedy these issues we modified the Mobiphos network infrastructure to run in Ad-Hoc mode, thus removing limitations of a centralized network and allowing the researchers to remain on the periphery of the group. We expected this change to increase the flexibility with which the groups could split and merge. However, as discussed earlier our Korean participants, Groups A, B and C, rarely separated from each other. We believe that this is an interesting statement on the importance of designing infrastructure with culture in mind. In both the American and Korean evaluations, participants movements with regards to each other were not dominated by technical limitations or capabilities but by the cultural norms regarding how a group of friends are expected to move with respect to each other.

5.4.3   Mobile Cues and Group Dynamics

Mobiphos uses vibration to alert participants that a photograph had arrived on their device from another person. The goal of this

feature was to allow the user to know a photograph had arrived when they did not see someone capture a photograph or are not visually attending to the screen. However, due to the strong cohesiveness of the Korean groups, the vibration alert was not often used for the intended purpose. Groups however did use them to mitigate photo sharing when there were delays in the wireless transfer. A common occurrence involved one person capturing a photograph as the group walked together. The participants standing beside the capturer would look at the photo on the screen of the capturer, thus falling back to existing practices of sharing the digital camera screen. Then when their device vibrated the users would break away from a single screen and each would make use of their own device to look at the photograph.

6. MULTICULTURAL RESEARCH TEAM

We conclude with a discussion of the importance in having a multicultural research team by analyzing the ability of the research team to fully understand various aspects of Mobiphos usage by combining observations of researchers embedded-in and external-to the culture of the participants. Having a multicultural research team during this evaluation was not simply a matter of fluency in the native language of the participants, it was critical to discovering and understanding interactions amongst participants. Peltokorpi et al. investigated expatriate assignments requiring interactions across cultural and linguistic boundaries and found that though traditionally expatriate failures have been ascribed to a lack of cross-cultural competence and cultural intelligence, language proficiency strongly contributed as well [16]. Unlike Peltokorpi et al., we viewed the lack of native language skills demonstrated by the American members of the research team as an asset to our work in the field instead of a hinderance.

6.1 Language Fluency

As stated earlier, the American researchers did not speak Korean. While many participant interactions were comprehensible there were a few instances where the interpretation would have been completely incorrect had it not been for the Korean researchers. In one such instance, an American researcher had classified a photograph as "meta-photography" because it appeared that a participant had taken a photo of their friend as she leaned against a wall while browsing photos. However, during a post-tour discussion amongst researchers it was discovered that the participant who was "browsing photos" was actually just pretending and was in fact posing for a very specific photograph. Later in the same tour, three group members stood in a variety of poses against a wall and the fourth member was asked to capture a photograph. The American researches thought that this was a spontaneously coordinated group activity, but actually, one of the group members had become frustrated with the rest of the group not performing the pose correctly and she orchestrated all the poses in that photo. What the American's perceived as a coherent group activity was actually a point of contention amongst the group members.

While the Korean researchers had some level of English proficiency, they found it difficult to understand the conversation of the American participants. The Korean researchers were able to understand the literal meaning of the American participants, but were unable to understand the conversation in relationship to the context. Additionally, the Korean researchers note that the pre-existing social relationship of our participants meant that the conversations amongst the participants could make use of past experience. These more subtle references were difficult to interpret and made it difficult to asses the level of emotion and intimacy amongst the participants. Finally, the Korean researchers note

that it was difficult to collaborate with their American counterparts when they were not collocated. While the study was conducted together, subsequent writing on our results was conducted after the American researchers had returned home. Due to the severe time differences and constrained schedules, communication was relegated to text-based mediums, such as email, and it was difficult to have an audio or video chat. This actually caused misunderstandings in English to be magnified. When collocated it was easy enough for the American researchers to, through short dialog, diagnose and correct any misunderstanding, however, when attempting to have the same sorts of conversation over email this resolution process was not easily available. To remedy the solution, we enlisted a Korean researcher working in the same lab as the American researchers to act as a translator.

6.2 Defamiliarization

For the American researchers, conducting the evaluation within a new culture allowed them to observe without the bias that accompanies working in one's own culture. The American researchers had no prior experience working with Korean participants. Unable to process the conversations that occurred during the study, the American researchers focused solely on observing participants body language, their interactions with technology, and their interactions with each other. This allowed the American researchers to observe and comment on behavior that was completely ignored by the Korean researchers. For example, the American researchers noticed that the Korean participants often employed use of specific face accenting gestures to hide from the camera. This is a common response, in Korea, when having your picture taken and it was completely unremarkable to the Korean research team. Further research into this type of photography uncovered numerous websites and forums which explain in detail how someone should take an "appropriate" photograph of themselves and how they should accent their face with a hand gesture such as a making a peace sign and placing it on the cheek or next to the eye, holding up an "OK" sign to the check or any of the many other popular poses.

The Korean researchers provided the American researchers with insights into the differences in the group level interaction. As stated earlier, the Korean participants generally moved as a single unit and made cooperative decisions, while the American participants were more individualistic in their photograph capture. The Korean researchers quickly noted this behavior and felt that it was very alien compared to the other groups. However, the Korean researchers interpretation of this behavior was that the American participants were having less of a "group" experience than the Korean participants. In the post tour focus group, conducted be the American researchers, it was found that the participants were in fact having just as much of a group experience as the other groups but in a way unique to their culture. This form of group experience, with individualistic tendencies, was also present in all of the groups studied in prior work [5, 15].

7. CONCLUSION

The cultural background of a technology user has a large impact on the way in which that technology is used and appropriated. We have explored this impact in the domain of mobile-collocated photo sharing with Mobiphos as our probe. We worked with a population which already makes heavy use of mobile-collocated photo sharing and studied the underlying themes of their usage. A multicultural research team was assembled to best analyze all aspects and to discover themes both within and outside of the users cultural norms. We compare our results with previous

work in mobile-collocated photo sharing to isolate cultural artifacts and provide insight into technology design for small-scale social groups. We conclude with a discussion on the importance of using such a multicultural team, hopefully encouraging other researchers to reach across borders and work together so that they may better understand user populations outside of their own.

8. ACKNOWLEDGEMENTS

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