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This is the author's version of a work that was submitted/accepted for publication in the following source:

Vyas, Dhaval, Keijl, Edwin, Akker, Rieks op den, Nijholt, Anton, & van der Veer, Gerrit C. (2013) Geo-locked photo sharing on mobile devices. In *Proceeding CHI EA '13 CHI '13 Extended Abstracts on Human Factors in Computing Systems*, ACM, Palais de Congrès de Paris, France, pp. 1407-1412.

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<http://dx.doi.org/10.1145/2468356.2468607>

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# Geo-locked Photo Sharing on Mobile Devices



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## Abstract

We introduce the idea of *geo-locking* through a mobile phone based photo sharing application called Picalilly (figure 1). Using its geo-locking feature, Picalilly allows its users to manually define geographical boundaries for sharing photos – limiting sharing within user-defined boundaries as well as facilitating open sharing between strangers within such boundaries. To explore the potential of geo-locking, we carried out a small scale field trial of Picalilly involving two groups of students, who were part of a two-week long introduction program at a university. Our preliminary results show that Picalilly facilitated 1) sharing of ‘places’ and 2) localized explorations.

## Author Keywords

Location-based Services (LBS), Mobile photo sharing

## ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

## Introduction

Smartphones with GPS (Global Positioning System) have a great potential to exploit location-based services (LBS) such as FourSquare, Gowalla, Google Latitude and Facebook Places. These services are typically used for supporting social networking, marketing, gaming or

**Figure 1.** Picalilly interface and geo-locked photo sharing groups.

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CHI 2013 Extended Abstracts, April 27–May 2, 2013, Paris, France.

ACM 978-1-4503-1952-2/13/04.

sometimes simply conveying presence of individuals at specific locations [3]. They exploit properties of physical locations for leveraging social activities happening within such locations. More importantly they change our notion of space, as they influence our social interactions and practices, and encourage a shift toward 'net localities' [6]. Especially, geo-tagged photos have started playing an important role in exploiting location related information and services. Applications have used geo-tagged photos for location-based gaming [2, 4], navigation [1], sharing local experiences [10] and social networking [3] purposes.

Picalilly is a group-oriented, real-time photo sharing application. Using Picalilly, users can create public or private groups, where participants can upload and view photos through their mobile devices. As a differentiator, Picalilly introduces the idea of *geo-locking*, by which users can manually define geographical boundaries to their photo sharing groups (figure 1). This geo-locking feature allows users to share photos only if the photo is captured within user defined boundaries of a photo sharing group. If a user moves out of the boundary, he/she can only view photos from the photo sharing group. To explore the potential of the geo-locking feature and to support our iterative prototyping, we carried out a small scale field trial of Picalilly. At a university introduction program, we recruited two groups of students and asked them to use Picalilly while they were going around different areas of the university and its adjacent areas. Our two week long field trial showed that although Picalilly did not support any specific location-based service, its geo-locking feature allowed our participants to 1) share experiences of specific locations and 2) explore local places within the geographic boundaries of different groups.

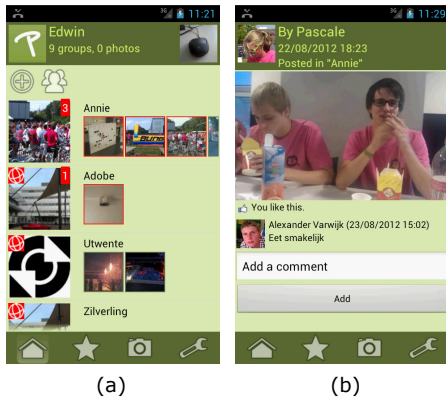
## **Related Work**

In recent years, geo-tagged photos have emerged to be an important source for LBS. For example, GeoNotes [9] allowed its users to create notes by combing images, texts and sound and placing them at specific physical locations, using mobile devices. When a new user passes through this area, he/she gets notified of these notes in either push or pull mode that the user has pre-specified. Using a channel metaphor, Zurfer [7] offered its users to explore Flickr photos taken near their current location via their mobile phones. Using the Columbus system [10], Rost et al. investigated how the presentation of photos from Flickr affected users' experiences when they passed through areas where the photos were taken and how the perception of built environment was challenged by the images that are 'un-locked' by the users on the go.

There are a number of applications that use geo-tagged photos for navigation and gaming purposes. Pauty et al. [8] describe a system that lets users virtually explore areas by browsing photos. Their system provides a view inside closed areas and allows users to see what these areas look like in advance, using their current position as a starting point. EyeSpy [2] is a game for gathering geo-tagged photos that can later be used to aid navigation. In [1], photos are shown in order to help users navigate to a specific location, as opposed to just offer a means for exploration.

## **Picalilly**

Picalilly is an Android-based photo sharing application, which allows its users to create public or private groups to enable them for sharing photos in real-time within such groups. Users can add new members at the time of creating groups as well as afterwards. All the



**Figure 2.** Main screen of Picalilly with recently updated groups first (a) and the individual photo view (b).

members in a group can upload and view photos; tag, like and comment on them. Photos shared via Picalilly are stored in the cloud and are made accessible whenever a user logs into the application. A member's profile page would show a list of all shared groups with recently updated groups at the top (figure 2a). Picalilly also notifies all users in a group whenever a new photo is uploaded or any update (e.g. comment, like) to a photo is done within the shared group. Figure 2b shows a photo within a shared group. While creating a group, Picalilly allows its users to define them either as private or public. In private groups, a user will have to invite other Picalilly users. Here, the sharing of photos will be secured and access rights will be given only to the group members. If a group is defined as public, then it allows any Picalilly users to join the group. The implementation of Picalilly is described in Text Box1.

Picalilly uses *geo-locking*, by which users can manually define geographical boundaries to their photo sharing groups. Once a photo sharing group has a geographic boundary, it allows the group members to share (upload and view) photos taken within the user-defined geographic boundaries. A member who goes out of the boundary can only view the photos uploaded in the group, he/she cannot upload photos in that photo sharing group. To this end, Picalilly constrains photo sharing activities for users who are outside of the boundaries. If a shared group is set as 'public', Picalilly allows open sharing within the defined geographic area where strangers can share photos, e.g. in a music festival. Users can view the available public groups surrounding his/her location and can join a group and start sharing photos to others in the group. If a geo-locked group is defined as 'private', only the group members within the defined boundaries can share

photos and others cannot view or upload photos. The geo-locking feature is also used to allow users to subscribe or follow specific locations as well as friends who go to such locations.

#### *Creating geographical boundaries*

If a user prefers to geo-lock his/her photo sharing group, Picalilly allows the user to manually locate an area on the Google Maps and by a long press the user can create a geographic boundary, as shown in figure 3. The map area on the screen is selected by this action and the top left and bottom right corner of the current projection of the screen are used to create boundaries. Here, the screen coordinates are converted into `GeoPoint` (a class provided by the Google Map API) which can specify geo-coordinates in micro-degrees. By following the same process, users can change these boundaries by zooming out or zooming in. The user is always notified by showing a dialog message that he/she successfully selected a location.

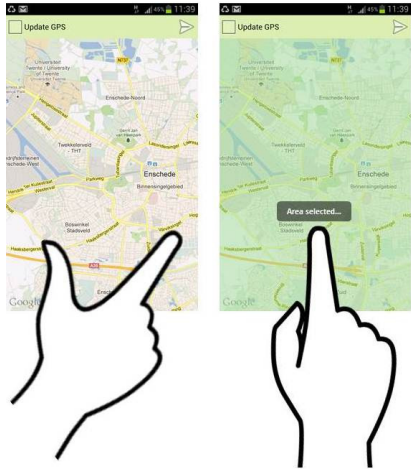
#### **Field trials of Picalilly**

During August 2012, we carried out a small scale field trial of Picalilly at an introduction week of University of Twente, the Netherlands. The program is called Kick-In, where new students participate in different in-door and out-door activities, involving games, picnic, sports and education related activities for two weeks.

We believed that Kick-In would be a useful venue to explore the use of locative media such as the Picalilly. The schedule of Kick-In showed that students, in groups, will be travelling around different parts of the university as well the nearby area. We believed that photo sharing through Picalilly may add to their experience of going around these places. During the

Picalilly client is written in Java using the Android SDK. The Google API Add-On is used to support interactive maps in the application and the Google Static Maps API for serving static map images. Furthermore, Google Cloud messaging is used for push notification functionality. Gson (a Java library) is used to convert Java Objects into their JSON formats. This is used to communicate with the web server through a RESTful JSON API. This API is written in PHP. The user data is stored in a MySQL database.

**Text Box 1.** Implementation of Picalilly in brief.



**Figure 3.** Creating boundaries: 1) locating an area on a map by zooming-in and out; and 2) a long press gesture.

event, we recruited two groups of students who were using Android smartphones. Both groups had four participants each. In a meeting, we explained about our research project and showed a demo of Picalilly. We then asked both the groups to “describe their Kick-In experience in photos and stories behind their photos.” We asked the groups to use Picalilly throughout the two weeks of Kick-In. During the use of Picalilly, we kept track of their photo taking activities.

At the end of the second week, we invited individual groups for an interview session. For this interview, we prepared a graphical representation of all the photo-taking activities that they did during the two weeks and asked questions about the use of Picalilly (figure 4). We used a whiteboard and stuck all the photos, based on timeline, users, and different groups they had created. We thought that when they see their activities with reference to others they would be able to answer our questions better. We analyzed the interview notes, photos they captured and the Picalilly logs.

### Findings

Though Picalilly was meant for sharing photos between members, the geo-locking feature of shared groups allowed our participants to share not only photos but also information pertaining to locations. Figure 5 shows some examples of photos that were shared using Picalilly. Our analysis sheds light on two interesting themes that we believe are relevant to geo-locked photo sharing: sharing ‘places’ and localized exploring.

#### Sharing “Places”

Following the ‘space’ versus ‘place’ analogy [5], this theme illustrates how Picalilly helped our participants share experiences related to different locations. In the

interviews, our participants indicated that geo-locked public groups took the function of informing others about the location and experiences surrounding it.

During the Kick-In program, our participants went for a camping trip (or freshman camp) outside of the university campus. Not all the students were scheduled to visit the camp on the same day. The group who participated in our study, called Tegel, wanted others to see what was going on at the camp. They intentionally shared photos of their group’s activities by creating a geo-locked photo sharing group. Tegel had created its own private group, but they chose to share photos from the camp to a public, geo-locked group. Two of the photos are shown in figure 5c and 5d. A participant from that group commented, “*I knew that there were many students at the camp other than us and many back at the campus. I wanted to share these photos so that others could know what we did here and what kind of activities they can expect.*”

At the university campus, participants attempted to convey information and experiences related to different activities that were part of the introduction program. Referring to figure 5a and 5b, a participant commented “*using Picalilly, new students can see how the university looks and what is going on around different areas. Important thing here is that this would not be the university’s official view point but a view point that is created by students. One may get a completely different view point here.*” It was also observed that users of Picalilly wanted to have more visibility of certain contents and other contents were shared more privately. In other words, photos that had some level of privacy concerns were kept within the private groups



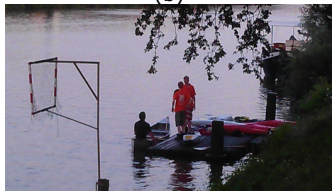
**Figure 4.** Joint interview session with the visual representation of our participants’ photo sharing activities.



(a)



(b)



(c)



(d)

**Figure 5.** Some examples of photos shared using Picalilly.

and contents that had a global significance were kept in public photo sharing groups.

From our analysis it also became clear that location and high-level activities of people became more important than people's faces. While looking through different photos a participant commented, *"I think the biggest difference in contents of photos across different shared groups is that the people in the pictures stay more or less the same but the surroundings and the location change per group, because you're attaching pictures to those locations. It gives you an idea of how the place looks."* We believe that the above comment from our participant is more relevant to geo-locked public groups, as participants were careful about that fact that such contents will be accessible to any random person who uses Picalilly. Hence, information about location and activities were given more importance than people's portraits.

#### *Localized Explorations*

The second interesting theme that came out of our field trial was that Picalilly offered exploration of locally relevant information. Even though the geo-locking feature enabled participants to share photos within certain boundaries, it encouraged and enabled localized exploration within the geo-locked photo sharing groups. When sharing photos through Picalilly, our participants discovered other existing geo-locked groups that were already created around them and in some cases they were encouraged to share photos to these existing groups. In some cases, our participants also subscribed to several locations to see if others posted photos in that particular area. One participant commented, *"As a new student, I would not have to look for a specific group. I would just make a subscription to the campus*

*area and get an idea of what is happening here. If you have a public group at a location, it would be interesting for new people to see what is here and how everything looks. You would get a sort of Google Street View look."* During the interview session, we asked a participant who subscribed to a geo-locked group called 'Enschede' about what types of notifications he was getting. The participant replied: *"I see there is a lot of booze in Enschede."* This view of the participant was based on a set of photos that showed alcoholic drinks.

Social navigation also became an important aspect of the use of Picalilly. Picalilly allowed new users to follow in the foot-step of users who visited different places around the university campus earlier. A participant commented, *"It might be that people take pictures of things that I missed in the area while walking around, so I think exploration is something that this application can help with. The extra information [comments/description] would tell me more if it is worth going there or if it is interesting."* One of the participants described that the geo-locked groups can be useful on holidays and sightseeing tours. The pictures that show places of interest can inform tourists and encourage them to go and see those places. He commented that *"For festivals such as Pinkpop this might be interesting. The organizers can create pre-arranged photo sharing groups on that location. Because it would be such a massive place, one would be able to explore things happening at different locations. That way you know what is going on elsewhere in the festival."*

#### **Discussion & Future Work**

This work is part of our ongoing efforts to develop mobile photo sharing applications [11, 12]. The main purpose of Picalilly is not to disclose locations or

provide navigational support to peers. It is in fact a photo sharing tool, where the enhancement of geo-locking feature adds a great amount of 'locational' value. In line with known photo sharing applications such as Color, Piictu and Vivogig, Picalilly focuses on supporting collaboration and interaction *through* photos. In the field trials, our aim was not to evaluate Picalilly but to explore the potential of the geo-locking feature and gather relevant information that can be useful in the next iteration of our development.

Our field trial highlighted two main themes: sharing location-based experiences and supporting localized explorations. We found that it was very intuitive for our participants to create geo-locks for their photo sharing groups. In future, we plan to carry out a longer term field trial involving a variety of settings and a larger number of user participation. This will guide us to explore the use of Picalilly in different contexts and its long-term effects on social issues. Some of the ideas such as using Picalilly in music festivals with more interactive possibilities will be thoroughly investigated in these field trials. Here, we will be able to provide quantifiable details of participants' photo sharing activities within public and private groups. Looking forward, we believe that we will have to build stronger filtering and summarizing features in order to support scalability, i.e. handling a large amount of photos that may be shared during different events.

### **Acknowledgement**

This work is funded by the European Commission, within the framework of the ARTEMIS JU SP8 SMARCOS project 100249. We thank Randy Klaassen, Jonathan Juursema, Wagesh Kulkarni and all of our participants.

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