

# Place this Photo on a Map: A Study of Explicit Disclosure of Location Information

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**Abstract.** This paper reports on the early results from an ongoing study of the use of popular photo-sharing platform. We specifically focus our investigation on the factors influencing the accuracy users choose to link their photos to the physical world. We believe that modeling these mechanism can impact the design of ubiquitous systems that support sharing and retrieval of location-enhance information. For instance, it could suggest guidelines to match people's expectations of granularity in location information. Our early results reveal that while familiarity with a place does not seem to influence the accuracy of the disclosed location, the city and type of urban landscape impact the use of coarse and fine-grained location information.

**Keywords:** Location-awareness, CSCW, ubiquitous computing.

## 1 Introduction

In the past years, research in location sensing and tracking has been dominated by figuring out where persons and objects are in space [3]. In comparison, very little work has been dedicated to understand how accurate is accurate enough, i.e., what is expected, sensed and desired [1] from location technologies. Our approach aims at revealing new evidences that can lead us to understand how we link digital information with physical space. We take advantage of the recent burst in the use of capture devices (e.g. mobile phones, digital cameras) and collaborative web platforms to share their content. This new type of user-generated information provide large amount of data to study how people make sense of location accuracy when explicitly binding digital data to the physical world.

The remainder of the article is organized as follows. First we mention related studies on location information granularity and spatial annotation in ubiquitous computing. Then, we describe our approach and the early results. Finally, we mention the follow-on analysis we are currently performing.

## 2 Related work

Currently, a majority of location-aware systems impose an abstraction layer to their users. For example in their seminal paper on spatial annotation, Espinoza et al. [2] propose a certain spatial granularity arbitrarily dictated by the accuracy of their positioning system and the campus maps. However, very little effort has been devoted to understand the coarse-grained and fine-grained information location-sensing systems should deliver to match the expected information by a user involved in a specific activity. In their aim to bridge the gap between the coordinate based pedestrian positioning system and the symbolic ubiquitous world model, Stahl and Heckmann [5] proposed three levels of abstraction: city, building, and room. Lin et al. [4] took a step further and provided an alternative approach towards location systems with varying granularities. However, these studies lack of empirical data to validate the applicability of their approaches.

## 3 Method

We study the photos uploaded on to the popular photo-sharing platform Flickr<sup>1</sup>. People use this service to share and organize photos with the option to geotag (i.e. link to a physical location) them. Users mainly perform manual geotagging through a map interface. Each time a photo is linked to a position, the system assigns an accuracy attribute according to the zoom level of the map used to disclose the location of the photo (e.g. from 8 for region/city level to the most precise 16 for street level). The collected data allow us to study two aspects that might influence the granularity employed to anchor images to the physical space (Table 1).

**Table 1.** Our studies aim at revealing the factors that influence the use of the accuracy feature in Flickr. We start with 2 possible relations that can be observed with our data.

Influence in granularity	Aim	Method
Type of urban environment	Does the type of urban landscape influence the granularity used?	Map the disclosed location information and accuracy level linked to photos to reveal which areas favor the use of the different accuracy
Familiarity with the area	Does attaching a position to a photo taken in a familiar area influence the granularity used?	Categorize users in inhabitants and visitors of Barcelona. Observe how each group use accuracy over time and space

<sup>1</sup> <http://www.flickr.com>

## 4 Early results

We collected location data of 1.66 million photos taken between January 2005 and April 2007 by 48,736 users in 12 of the most photographed cities in the world (e.g. San Francisco, New York, London, Paris, Tokyo, Sydney). The results we present mainly reflect the early analysis of explicit location disclosure of photos taken in Barcelona (90,967 photos geotagged by 3113 photographers).

### 4.1 Type of environment

The comparison of 12 of the most geotagged cities in the world revealed two major patterns in the way users employed the accuracy feature. In a first group of cities the use of accuracy peaks the large city and street level, leaving levels in-between underused. On the other hand, another group of urban environments reveal a steady growth in the number of photos from coarse to fine grained granularity without any specific peak at the large city level. As a result, understanding the influential factors to the use of city level type of granularity in some cities and not others needs a deeper investigation.

Further, the unique analysis of the city of Barcelona reveal that the vast majority of photos are bounded to the tourist heart of the city. Photos with coarse-grained location information (i.e. accuracy 12, city level) are linked with the major and easily detectable points of interest of the city. The neighborhood accuracy almost uniquely targets the dense urban space of the old town and seems irrelevant to disclose photos taken in the main points of interests. On the other hand, fine-grained location information (i.e. street level) emerge in the main path taken by tourists, but are barely present in the wide space such as the city parks (Figure 1).



**Fig. 1.** Heat maps of Barcelona revealing the density of the photos for the accuracy levels 12 (first from left) to 16 (last from the left).

### 4.2 Familiarity with the area

We arbitrarily categorized users between visitors and inhabitants from the amount of periods they have taken photos in the studied areas. For example, a user with sets of photos of Barcelona taken over 2 different months was considered as a Barcelonian. Our early analysis, limited to the city of Barcelona, reveals absolutely no difference in the granularity used by visitors and photographers more familiar with the city. An

investigation on the use of accuracy according to the different urban landscapes will need to be further performed.

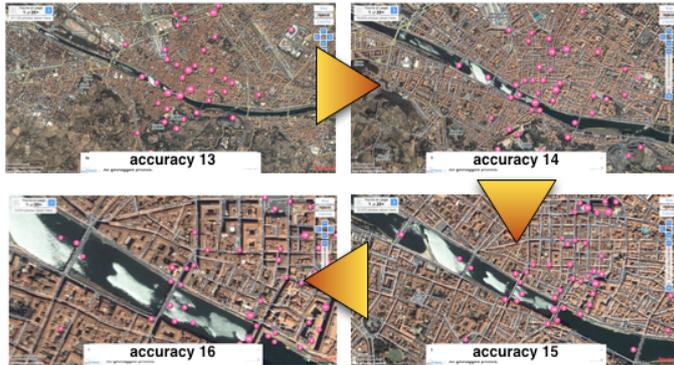
## 5 Conclusion and future work

The early results we present in this paper confirm the potential of our approach to understand how people employ the accuracy of location information to link digital information with the physical world. We believe that it can provide further understanding on the nuances in the granularity employed by people to retrieve and communicate location-enhanced information. As a result, it could provide informed suggestions and guidelines for the design of future location-aware applications to match what can be sensed by technologies with what is expected by users.

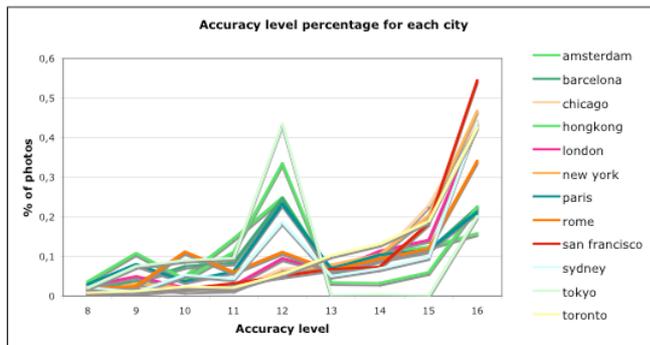
The next steps in this study aim first at conducting a more systematic analysis of the collected data to define the influence of space on accuracy. Second, we plan to investigate the link between the intentions for geotagging (e.g. retrieving, communicating) with the accuracy. Finally, the data should help use understand in more details the profiles of “geotaggers” and the evolution in the use of the accuracy feature. In consequence, we are developing a spatio-temporal data analysis tool to investigate the use of the spatial features in Flickr and expand the study over the selected cities.

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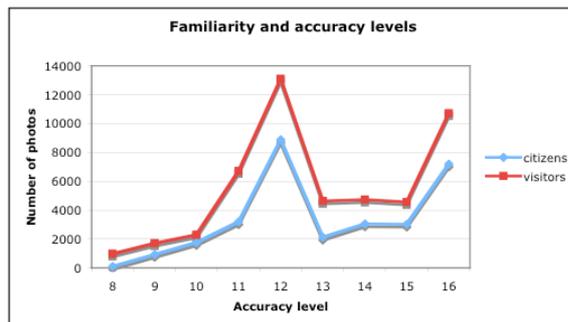
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**Fig. 1.** Accuracy levels defined in Flickr to geotag photos. The image show the transition from level 13 to 16 for the city of Florence



**Fig. 2.** This chart reveals the two different patterns to disclose the position of a photo. One group of cities favor the accuracy level 12.



**Fig. 3.** This chart shows almost identical patterns between visitors and citizens of Barcelona in their use of the accuracy to position their photos