

Why We Tag: Motivations for Annotation in Mobile and Online Media

Morgan Ames¹

Department of Communication
Stanford University
morganya@stanford.edu

Mor Naaman

Yahoo! Research Berkeley
Berkeley, California
mor@yahoo-inc.com

ABSTRACT

Why do people tag? Users have mostly avoided annotating media such as photos – both in desktop and mobile environments – despite the many potential uses for annotations, including recall and retrieval. We investigate the incentives for annotation in Flickr, a popular web-based photo-sharing system, and ZoneTag, a cameraphone photo capture and annotation tool that uploads images to Flickr. In Flickr, annotation (as textual tags) serves both personal and social purposes, increasing incentives for tagging and resulting in a relatively high number of annotations. ZoneTag, in turn, makes it easier to tag cameraphone photos that are uploaded to Flickr by allowing annotation and suggesting relevant tags immediately after capture.

A qualitative study of ZoneTag/Flickr users exposed various tagging patterns and emerging motivations for photo annotation. We offer a taxonomy of motivations for annotation in this system along two dimensions (sociality and function), and explore the various factors that people consider when tagging their photos. Our findings suggest implications for the design of digital photo organization and sharing applications, as well as other applications that incorporate user-based annotation.

Author Keywords

Annotation, tagging, digital photographs, cameraphone, incentives, motivations, photo sharing, collection organization, location-aware, CSCW.

ACM Classification Keywords

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

INTRODUCTION

Innovations in consumer photography have made it exceedingly simple for people to capture images, which they do at an ever-growing rate. This growing capture rate

is driven by the proliferation of capture devices (such as digital cameras and cameraphones) together with decreasing storage costs. At the same time, creation of semantic metadata about photo content remains an elusive goal. Some amount of annotation can significantly improve the usefulness of such photo collections as they grow into the thousands; the most commonly-cited benefits are to help recall and support search [11]. However, algorithms for semantic interpretation and annotation of image content are far from reach by any automated system. As a result, the owner of the collection is tasked with the labor of annotating their photographs.

Providing tools for annotation of media is therefore an active field of research in human-computer interaction [3, 8, 21]. These research efforts, mainly focused on desktop-based tools, attempt to ease the annotation task as well as maximize the benefits for annotating content [10]. While some of this research has been incorporated into commercial photo browsing systems (like Adobe Photoshop Album), most people still do not bother with annotation of their photos [17], though they do say they think it would be useful for photo retrieval and wished they did it much more. Clearly, the perceived benefits of annotation – which are vaguely-defined and at some indeterminate time in the future – do not overcome the investment [7], even with the most advanced annotation systems.

The motivations for tagging changed with online photo sharing communities such as Flickr [1]. Flickr allows annotation of photos in the form of tags, or unstructured textual labels. The tags in Flickr are mostly assigned by the user who uploads the image [11], and provide multiple benefits. In addition to making the photo searchable by the contributing user, tags enable users to discover other users' photos. In other words, the traditional use for annotation, personal organization and retrieval, is now augmented by the ability for users to expose their photos on-line to be viewed by other members of the Flickr community.

ZoneTag is a cameraphone application used to upload photos taken by the phone to Flickr. ZoneTag is loosely based on the MMM system [19] designed to capture, annotate, store and share photos from the phone. Most

Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. To copy otherwise, or republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee.

CHI 2007, April 28–May 3, 2007, San Jose, California, USA.
Copyright 2007 ACM 978-1-59593-593-9/07/0004...\$5.00.

¹This research was conducted while the first author was at Yahoo! Research Berkeley.

importantly, ZoneTag attempts to encourage annotation on the phone at the time of capture by providing tag suggestions.

The combination of Flickr and ZoneTag allows us to study this new class of photo organization, annotation and sharing environments. Indirectly, the study reflects on a broader class of web-based “tagging systems” that have recently become commonplace [11]. The motivations and incentives for participation and tagging in these systems have not been widely studied to date. We attempt to find out why users of Flickr “tag” their content. The study may shed light on motivations in other systems too, a direction we would like to pursue in future work.

Our contributions focus on the tagging activity in ZoneTag (and Flickr). Specifically, we:

- Examine the motivations for annotation and tagging in Flickr and ZoneTag via user interviews and other qualitative methods.
- Describe a taxonomy of motivations to annotate content in this system.
- Study the role of tag suggestion in the system; specifically, the ways these suggestions affect the behavior and patterns of tag use.

We offer implications for designers of systems for photo annotation and organization; for designers of other tagging and annotation systems; and for designers of mobile capture devices like digital cameras and cameraphones.

RELATED WORK

Efficient labeling of photos has been an active research field since 1999. Work in [3, 5, 8, 21, 25] addressed ease and partial automation of the labeling task on one hand, and expanding the benefits of annotation on the other. For example, [21] proposed a drag-and-drop approach for attaching labels to identify people in photos. The latest photo browser commercial packages, such as Adobe Photoshop Album, adopted similar methods to support easy labeling of photos. More recent efforts [3, 14] utilize temporal and spatial context to assist in labeling photos in personal collections. However, a recent study by Kirk *et al.* [7] on management of personal photo collections has determined that users often use only event-based organization for their photos and apply little or no additional annotation or organization.

Some projects have considered collaborative work on labeling photographs, allowing many users to label a shared collection of images. In [9], participants annotated a public collection of photos from the CHI 2001 conference. While this study is geared towards an existing community, a broader example can be found in current online photo sharing systems like Flickr [1]. In Flickr, users label photos with tags or captions. Communities and photo pools are often created in an ad-hoc manner as users annotate with the same tags (*e.g.*, people interested in photos with the “CHI 2007” tag). The ESP game [24] offers a different version of collaborative tagging, where the user incentives

are designed into a game. ESP randomly matches two physically and virtually separate users (the two cannot communicate). The game simultaneously presents the users with the same photo and users earn points if they type in the same textual label.

Collaborative tagging and annotation systems, for photos as well as other resources, are a growing area of interest in the HCI community. Golder *et al.* [4] studied tagging dynamics and reported on usage of different types of tags in Del.icio.us (<http://del.icio.us>). Sen *et al.* described personal and social influences on tagging behavior in MovieLens [20]. Marshall [12] analyzed annotations in reading material along a number of dimensions including formality, permanence, and explicitness, among others. Though her work is focused on personal annotation, the informal “ecological” annotations she observed are similar to the tagging in ZoneTag and other social tagging systems. Finally, Marlow *et al.* [11] offer a taxonomy of collaborative tagging systems; report on different incentives for tagging, categorized as social vs. organizational; and provide an initial study of the tagging dynamics on Flickr. We extend their work by providing a more detailed taxonomy of tagging motivations on Flickr. In addition, we ground our work in user interviews and other qualitative methods, providing a deeper understanding of real-world user attitudes.

The idea of sharing media metadata between users to assist in annotation was introduced in earlier work [13, 19]. In this form of collaborative tagging, metadata such as tags and labels is shared, mostly based on spatial and temporal context. The system developed in [19] for cameraphones was the first iteration on a collaborative tagging client for the mobile phone platform. That work proposed annotation using person, location, object and activity categories. As we show below, a number of key conceptual and usability lessons from that system and subsequent efforts were incorporated into ZoneTag.

The HCI community has recently become interested in investigating current cameraphone usage [6, 15, 22], developing new experiences around mobile photos [18], and studying new forms of sharing [22]. Although the types of pictures taken in ZoneTag show patterns similar to the ones described in [6, 22], it is the first such system that uses a popular, web-based photo sharing system such as Flickr, with an audience much wider than those actually using ZoneTag. In addition, Flickr differs from traditional photo-sharing sites in that photos are by default public, enabling one-to-many sharing rather than one-to-one. We describe Flickr and ZoneTag next.

FLICKR

Flickr is an active photo sharing web site and community [1]. At the time of writing, Flickr has over 5 million registered users and over 250 million images. There are various controls and settings associated with each photo uploaded to Flickr; the relevant ones are listed here. First, privacy settings allow users to specify whether each photo

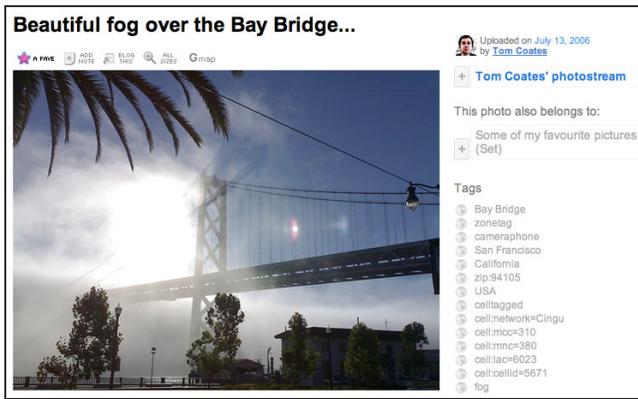


Figure 1. A ZoneTag photo page on Flickr; tags are displayed on the right. Visitors to the page can click on a tag, or on the earth icon next to it, to see photos with this tag from this user or from the entire Flickr community, respectively.

can be viewed by the public, by the users that Flickr members have specified as friends and family, or just by the user. Second, the user can assign a title and a caption to each photo (placed above and below the photo, respectively).

In addition to these settings, the user can enter a set of textual labels for each photo, also known as tags.² The Flickr interface displays these user-entered tags to the right of the photo on the photo's page (Figure 1). Thus, one function of the tags is descriptive, providing additional information about the photo that may not be reflected in the title or the caption.

Users can also use tags to search for photos in their own collection, in another user's collections, or across the entire public pool of photos. A search mechanism returns photos whose title, caption, or tags matches the search query. A tag-specific retrieval mechanism is also available: a user can search for all photos with a specific tag in their private collection, in another user's collection, or across all public photos.



Figure 2. The upload dialog (left) and the tag suggestions and entry screen (right) in the ZoneTag interface.

² A user can allow other Flickr users to add tags to his or her photos. However, the practice of adding tags to photos taken by others is not prevalent [11] and we shall ignore it here.

ZONETAG

This section describes the key relevant aspects of the ZoneTag application that iterates and improves on previous efforts [19]. In particular, we briefly discuss the photo capture and upload flow, and expand on the post-capture interface that allows the user to associate metadata in the form of tags to the photos.

ZoneTag is a mobile application available as a public prototype for Nokia and Motorola phones.³ Using ZoneTag, users can upload a newly-captured image from their cameraphone to Flickr [1] in as few as two clicks. After a photo is captured, ZoneTag displays an upload dialog over the image (see Figure 2). The user can review the image and decide whether she wishes to upload it to Flickr. In such cases, more options are shown. Clicking the same button again will upload the image, keeping all the settings and tags entered for the previous photo.

Most importantly, the user has an option to type in or select tags that will appear when the photo is displayed on Flickr. The tag-entry screen includes context-based tag suggestions that are pre-fetched from the ZoneTag server and sorted by the likelihood that the user will select a particular tag, given contextual information described below. The tags are grouped into categories reflecting tag sources. The tag categories, shown as tabs in the user interface (see the right side of Figure 2), include 'local tags,' which are tags created by the user, by members of their social network, or by others in the current location; 'recent tags,' which are tags the user has used within 24 hours; and a comprehensive list of 'all tags,' including tags the user has either entered on the phone or applied to a ZoneTag photo on the Flickr website. In addition to user-contributed contextual tags, ZoneTag incorporates tags from sources like place and event databases. These 'canned' tags are served and sorted based on physical location. Within each tab of tags, a user can quickly search through the available tags by scrolling or by entering the first few letters of a tag in the search box.

Optional pre-upload settings allow users to control various features, including the photo's privacy settings, the title for the photo, and the presence of ZoneTag's automatic location tags (such as city name).

The details of how tag lists are generated, sorted, and transmitted to the mobile device exceed the scope of this paper. Briefly, ZoneTag considers location and time as primary sources of context. The system aggregates all tags from a similar context, and then ranks them by frequency and various likelihood measures, giving more weight to the user's tags and then to tags used by people in the user's social network. For example, if a user takes photos at home and tags them with "home" and the names of others present, all these tags will appear as suggested tags when the user takes additional photos at that location. In another example,

³ Our description here applies to the Nokia version of ZoneTag.

when a user takes a photo at a location where many users have used the tag ‘Golden Gate Bridge’, that tag is likely to be suggested.

We found that ZoneTag was especially interesting as a platform for the study of emerging tagging motivations because it has incorporated some significant lessons from previous systems, including the following.

- ZoneTag uses a vibrant photo sharing platform, Flickr, as a destination for the generated content. In Flickr, photos are guaranteed to be archived for a long period, creating further motivation for photo capture. In addition, using Flickr, ZoneTag users can interact with users outside the ZoneTag system, thus potentially expanding the sharing and interaction around their photos to millions of users who are not in the ZoneTag system.
- ZoneTag provides various benefits for tagging photos, mostly based on Flickr’s affordances for tags. In past work, there was no immediate value to users annotating their photos.
- In previous systems, the user had to annotate each photo before it was uploaded. In ZoneTag, we made the annotation step optional on the path to upload. Users who are not interested in tagging are not burdened by the extra step and still find ZoneTag useful. Moreover, when necessary, even users who would usually tag their photos can upload a new photo quickly with no tags, or with the previous photo’s tags still attached.
- The tagging interaction itself is improved significantly, optimized for simplicity and speed. Tag suggestions are pre-fetched from the server and shown without delay when the user chooses to view the tagging dialog. In previous systems, tags were not pre-fetched and the tagging dialog only appeared after a long delay, which made the system considerably less usable.
- Previous systems solicited annotations in multiple semantic categories (*e.g.*, “place”, “event”, “activity” and so forth). In our system, the annotation – in particular, the tags and the tag suggestions – are drawn from a flat un-categorized space, which seems to be more conceptually accessible to users than faceted metadata.

DEPLOYMENT

ZoneTag has been deployed as a publicly-available prototype for over nine months. Most, but not all of the users of ZoneTag are self-selected early adopters of technology (we found later that similar patterns of tagging and contribution arose within both technical and non-technical taggers). As of January 2007, ZoneTag was used by more than 500 people that uploaded over 45,000 photos to Flickr, an average of about 90 photos per user. At the time of the study, 172 users had taken more than 10 photos using ZoneTag; our data analysis below mostly focuses on these users.

During deployment, we have collected detailed data regarding the usage of the system, which we have used to examine tagging patterns and activity. The goals of the

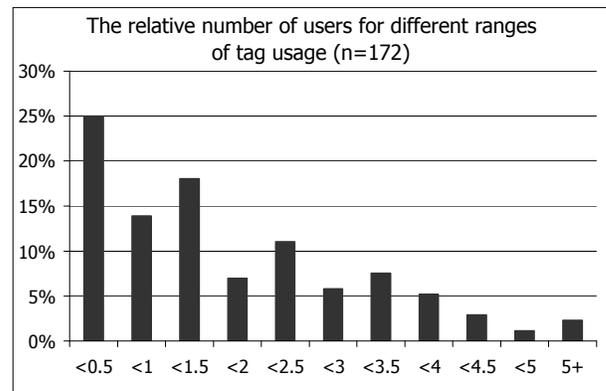


Figure 3. ZoneTag users’ tagging frequency across their entire Flickr collections (including untagged photos).

short analysis below are to examine whether the data indicate emerging trends in how ZoneTag users use tags for their photos, and whether the tag suggestions have some effect on the usage of the system.

The collected data included the settings applied to images through ZoneTag and on Flickr including privacy settings, image title, and tags, allowing us to closely inspect the user’s tagging activity. For example, we could learn which tags were added to each photo on the phone and which were added on the web using the Flickr interface. Moreover, for tags added from the phone, we can tell whether the tag was typed in or selected from the list of ZoneTag suggestions.

Figure 3 shows the percentage of ZoneTag users (y-axis) whose average number of tags fell into each range (x-axis). We include all tags that users added to their photos, whether on the phone or on Flickr, as well as photographs in the users’ ZoneTag collections with *no* tags. For example, the leftmost bar indicates that for 25% of the ZoneTag users, the average number of tags per photo in their collection was smaller than 0.5 (in other words, they added one tag to every other photo or fewer, on average). The aggregate of all bars, *excluding* the leftmost two, indicates that 61% of ZoneTag users added, on average, at least one tag per photo. Note that this count does not include the automatic tags that ZoneTag adds to photos, such as location names and other default tags.

Our users’ approaches to tagging on the mobile phone or on Flickr varied considerably. Of the users that regularly tag their photos, many do so on the phone as they upload a picture, using the ZoneTag interface. Over two-thirds of the ZoneTag photographs that were tagged at all were tagged from the phone. Users also may revisit their photos on the Flickr website to add tags. Some users exclusively choose this web-based route for tagging, never adding any tags on the phone.

Initial evidence demonstrates that the tag suggestions in ZoneTag have increased the number of tags associated with photos in the Flickr interface. The users of Shozu (<http://shozu.com>), another cameraphone application that uploads images to Flickr, provide a point of comparison.

The installation, distribution, usage, and supported phones of Shozu are all similar to ZoneTag. As a result, we assume relatively similar user characteristics between the two systems. A key difference between the systems is that in Shozu, if users wish to tag their images on the phone, they are required to type the tags in without the application's aid. Even though users in both systems could always add missing tags on the web using the Flickr interface, the easier tagging mechanisms in ZoneTag result in a larger number of tags per photo overall (including web-entered tags). Based on a recent sample of Shozu images on Flickr, the average number of user-entered Flickr tags for a public Shozu photo is 0.97 (standard deviation = 2.05, $n = 4087$). The number of such tags for a ZoneTag public photo is 2.2 (standard deviation 2.15, $n = 18417$). Despite the high variance, these numbers may indicate some effect of ZoneTag's tagging environment.

The patterns that exist in ZoneTag and Flickr data have indicated that while users' tagging behavior varies, ZoneTag appears to aid in tagging. These patterns also informed us that many different factors and motivations come into play for users who tag their photos. For example, the average number of tags attached to a non-public ZoneTag photo is 1.85 (standard deviation 1.892, $n = 24089$), lower than the average of 2.2 tags attached to a public ZoneTag photo (again we point out the high variance). In any case, we set out to investigate these motivations qualitatively via open-ended user interviews.

INTERVIEWS

The main part of our study involved in-depth, semi-structured interviews with 13 participants, including some of the ZoneTag users who had taken the most photos. Four of our participants were female. The participants ranged in age from 25 to 45 with most in the 25-35 range. While there was an over-representation of technical people (9 out of 13), we found that the patterns of use did not differ much between our technical and non-technical participants. Amongst our participants, the average number of user-added tags per participant per photo ranged from zero to more than five.

Our interviews consisted of a casual conversation about Flickr and ZoneTag use, followed by a more detailed discussion of tag usage and motivations for image capture and tagging. In a final, directed portion of the interview, we used the photo elicitation technique discussed in [23] to ask about specific tags used by participants for their Flickr/ZoneTag photos. We viewed Flickr photos and their associated tags with the participants and discussed specific patterns in tag activity such as sudden spikes and drops. Finally, we asked the participants about tag suggestions and their understanding of the source of these suggestions.

RESULTS

We first discuss key issues regarding the type of photos taken by our participants and the motivations for photo capture. Once the reasons for capture are established, we

look at the different motivations for tagging as found in the interviews. Finally, we report on how tag suggestions influenced our participants' tagging behavior.

Reasons for Photo Capture

Generally, the types of photos captured in our system did not stray from previous research findings for photos in cameraphones and digital cameras [2, 6, 15, 22]. For example, Kindberg et al [6] have classified the reasons for cameraphone image capture into two dimensions: social vs. personal, and affective vs. functional. In particular, social/affective photographs are photos taken for sharing with friends and family members (either to share mutual experience or to connect with absent friends and family). Indeed, despite the one-to-many sharing aspect in ZoneTag and Flickr, the usage of ZoneTag and Flickr amongst all our participants (and seemingly amongst the broader ZoneTag user base) is similar to the usage of mobile photos as reported in [6], with one significant difference. In our system, the fact that the photos are uploaded to a (potentially) publicly-accessible web site can introduce additional motivations for taking and sharing photographs. These motivations are best described as artistic exposure and recognition.⁴ Using the taxonomy of Kindberg et al, this type of usage would still fall under the social and affective usage categories. However, in this case, the photos are sometimes intended for general public as well as social cohorts. As we show below, this new category of sharing motivations also drives some of the tagging activity in Flickr and ZoneTag.

The relatively high image quality available from the cameraphones used by our participants – especially compared to the image quality of cameraphones used in previous studies – may have also influenced their reasons for photo-taking (most participants' cameraphones supported a resolution of 1.3 to 2 megapixels). We suspect that a higher number of photos were taken for archival-related purposes than the numbers described in [6, 22]. While we did not try to reproduce the numbers reported in these studies, there is certainly a sense of moving from capturing throwaway images with the cameraphone to more regular, digital-camera-like capture behavior. For instance, three of our interview participants reported taking their ZoneTag cameraphones, and no other camera, on vacation with them.

To summarize, the users we interviewed and the photos they took have similar characteristics both to mobile sharing behavior (always-there capture device, ease of sharing) and traditional photo taking (better quality, archival purposes). Our observations are therefore potentially applicable to a wide range of photo sharing applications and to different capture devices, including both digital cameras and cameraphones.

⁴ Van House *et al.* [22] found similar artistic expression activity in one-to-one sharing of cameraphone photos.

Motivations for Tagging

Our interviews surfaced a wider variety of motivations and uses for annotation and tags than discussed in previous studies. Few participants annotated their ZoneTag/Flickr photos solely for the traditional organization and self-retrieval benefits. Moreover, there were often multiple motivations involved even in the use of a specific tag for a specific photo. Still, we found that most of our participants generally had one or two primary motivations for tagging. For instance, one participant visited Hawaii and tagged his photos with tags that both intended to help others find his photos, and conveyed information and opinions about the photo itself, such as “Aloha Air sucks” or “good restaurant.” Another participant added tags to allow herself to find her photos later, as well as to provide contextual information for friends and family viewing her photos.

We developed a taxonomy for the revealed set of annotation motivations, as shown in Table 1. There are two dimensions along which we place the different incentives for tagging photographs. The first dimension, “sociality,” relates to whether the tag’s intended usage is by the individual who took and uploaded the photo or by others, including friends/family and strangers. This is similar to Kindberg et al’s. The second dimension, “function,” refers to a tag’s intended uses. We found that users tagged their pictures either to facilitate later organization and retrieval or to communicate some additional context to viewers of the image (whether themselves or others). Our “function” dimension focuses on the motivation for adding tags and differs from Kindberg *et al*’s functional/affective dimension, which focuses on the intended use of the photograph itself and does not differentiate communication.

The *social* category of the “sociality” dimension (second row of Table 1) is where tagging incentives that are not part of traditional personal media management are introduced. These ‘social’ motivations, as discussed later, are actually by far the most common motivation for tagging that our participants reported. As more people use their cameraphones and upload their images, we expect that these social motivations will continue to grow.

In the following sections, we discuss each of the motivation categories listed in Table 1 and provide examples from our interviews. We then report the motivations that are primary for each of our users.

		<i>Function</i>	
		Organization	Communication
Sociality	Self	<ul style="list-style-type: none"> * Retrieval, Directory * Search 	<ul style="list-style-type: none"> * Context for self * Memory
	Social	<ul style="list-style-type: none"> * Contribution, attention * Ad hoc photo pooling 	<ul style="list-style-type: none"> * Content descriptors * Social Signaling

Table 1. A taxonomy of tagging motivations in ZoneTag/Flickr.

Self/Organization: Search and Retrieval

The “self/organization” set of motivations, in the upper left corner of Table 1, represents the traditional annotation motivations in personal photo collections [3, 21]. Participants that are driven by this motivation to tag sometimes made comments such as “I am an organized person” or “I like order.” Often these comments are accompanied by apologies for not being *more* exhaustive or consistent in tagging, or by guilty laughs for being “obsessive” about it. Two participants (see Quote 1 for one example) say they are motivated to tag specifically to later retrieve their pictures for sharing; two other participants also report tagging for personal organization purposes.

Quote 1 (P6). Mostly I use [tags] if I go back on Flickr, if I want to find all the pictures of one thing. If I tagged ahead of time I can go back and get all my pictures of [my children]. ... I’ve made separate tags of [my child’s] preschool or playgroup so that if I want to share pictures with more than just family I can go back and find everything from that one tag. ... Mostly it’s for my own organization at this point.

Quote 1 illustrates one participant’s self/organizational motivations for tagging. The participant code (e.g. P6 is participant 6) is in parentheses.

Self/Communication: Memory and Context

Sometimes participants enter tags to add context to a photograph, such as the names of the people that appear in it or the name of the place it was taken, in order to aid future recall of the situation it depicts (see Quote 2 for an example). The “self/communication” section of our taxonomy (the top right square in Table 1) reflects this set of motivations.

Interestingly, though adding context is the traditional motivation for annotating printed photographs [16], relatively few participants were motivated in this way when tagging their ZoneTag/Flickr photographs. Even when users made their cameraphones their primary capture device, and despite the fact that their cameraphones produced pictures that are good enough for archival purposes, we found that the memory function of tags was still not a popular motivation. While it is likely that tags will provide this function as a currently-unanticipated benefit in the future, adding context to facilitate remembering details about photographs was not a primary motivation for tagging in the present.

Quote 2 (P2). If I have the time, the neighborhood, or the event, I have enough information to look at my own collection and know where this came from. I don’t have the bandwidth to tag for the benefit of the Flickr system. ... I want at least one hook of association in there that can help me reconstruct what I was thinking. I don’t have time to put all the hooks in but I can put one in.

Quote 2 illustrates one participant’s self/communicative motivations for tagging.

Social/Organization: Public Search and Photo Pools

The “social/organization” category of our taxonomy (the lower left square in Table 1) represents the user’s motivations for making their photos findable by others. The reasons for capturing the corresponding photos are social as well, and mostly “affective” rather than functional. As Kindberg *et al.* point out [6], photos are often captured to enrich or document mutual experience, or to share experiences with remote friends and family; in Flickr, photos can also be shared with the public. The tagging motivations that follow ensure that the photos can be easily found by specific people a user might want to share with (such as friends of family), or discovered by anyone who may be interested in the photo.

Flickr is fairly unique in having a large and vibrant public photo pool. While some participants tagged specifically for their family or friends (*e.g.* Quote 5), others had this wider audience in mind when adding tags (*e.g.* Quote 3). One participant said that friends and family followed his photos and didn’t need to use his tags to find photos; thus, his tags were just for the general public.

While seemingly altruistic, even sharing photos for the general public has, in the Flickr system, personal motivations. A clever feedback system alerts the user to the number of times each photo was viewed, chosen as a favorite by others, or commented on, providing the photographer with the satisfaction of knowing their pictures are getting attention and that they are gaining a good reputation in the Flickr community.

Two participants described ways of “gaming” the system by using certain tags to attract more views (*e.g.*, Quote 4). In some cases, the participant also wants to promote the subject of the picture (for one participant, a local band) as well as the picture itself. We and others are studying additional motivations for posting pictures publicly on sites such as Flickr, but these are beyond the scope of this paper.

Quote 3 (P6). I tagged [this new restaurant] because it just opened and it was new and I wanted to tell people what it was. ... It was a new place and probably that would be useful if other people were going there for the first time.

Quote 4 (P3). Mostly friends view my photos, but as I grow my collection, I am getting more [public] views. I’ve noticed that if I take [and tag] pictures of cute female friends, views go up. ... There’s a satisfaction that 50 people have viewed my photos. I know that tagging can connect my photos to activities, and get more interest. ... I’m getting more liberal about using suggested tags lately, so will add multiple tags to make it easier for people to find my photos.

Quote 5 (P6). When my sister’s baby was born she got a new tag, and at one point my dad was clicking on the [child’s name] tag ... [the tag provided a way to] sort by child.

Quote 3 and Quote 4 illustrate one aspect of social/organizational motivations for tagging: public search and self-promotion. Quote 5 is an example of tagging so that friends and family can search; the rest focus on the general public.

As more people, including groups of friends, tag their photographs, other interesting behaviors emerge. Two of our participants reported coordinating tags with others in order to facilitate later search and retrieval, forming, in effect, an ad-hoc, distributed photo “pool.” One participant did this explicitly with other users in many settings, ranging from company meetings to parties, from classrooms to hikes with friends (Quote 6). Another attended a race and parade in San Francisco and used the tag that others were using in order to tag his own photos and to find others’ photos of the event later. Still another heeded his friends’ wishes in adding their usernames to photos with them in them so that they could find pictures of themselves later (Quote 7).

Participants also reported being motivated to include tags so that the tags would be suggested to other users taking photos in the same location. At least three interview participants explicitly mentioned tagging their photos in part to make the tags appear in others’ suggested tags list (see Quote 11 for an example). While these users did not explicitly coordinate their tagging with others, they realized this “coordination” would happen implicitly. If successful, this implicit coordination will allow the users to search for the photos others took of the same event or in the same place. This motivation was facilitated by participants’ knowledge of the suggested tags feature of ZoneTag, which in effect helps to standardize the tag pool in Flickr. We provide more discussion on suggested tags below.

Quote 6 (P8). I’m at an event and there’s a convergence on a specific tag, then I’ll tag because it’s for the good of the group. ... It’s a nice way to build live streams and collections of photos. ... [A classmate] suggested we tag everything specifically so we can find it, which is actually really useful.

Quote 7 (P3). If I’m out with friends ... they might suggest tags. A couple of my friends will say “put my user ID in there” so they can find the picture. ... Using my user ID on my Flickr photos pulls my photo into certain streams.

Quote 6 and Quote 7 illustrate another aspect of social/organizational motivations for tagging: photo pools and tag normalization. Both quotes are examples of tagging primarily for friends and family.

Social/Communication: Context and Signaling

The final category in our taxonomy (in the lower right corner of Table 1) includes the “social/communication” motivations for tagging. Here, participants tag in order to communicate contextual information to others about the image and consequently about themselves as photographers, as Marlow *et al.* discuss in more detail [11].

In most cases, participants added these contextual tags for the benefit of known others, such as friends or family – see Quote 8. Only one participant indicated adding descriptive tags for the general public: in Quote 9 the participant describes leaving restaurant and airline reviews in his tags. Adding descriptive tags for known others often involved using tags that have little meaning without additional

context, as is the case with inside jokes or nicknames (relating to the discussion of “common ground” in [6]). In fact, some participants, in order to maintain privacy, purposefully obfuscated their tags so that friends or family would understand what the tags meant but the general public would not.

The two participants who had several friends and colleagues using ZoneTag reported an additional in-the-moment social/communicative motivation for taking pictures. They found that taking and tagging was a socially contagious activity. If one person took a picture, others also took out their cameraphone: the act of taking a picture “signaled” the event as photo-worthy, as also observed by Van House *et al.* Additionally, these two participants reported using tags as a way of exchanging information and inside jokes with friends in the moment, exploiting the socially- and locally-situated tag-sharing feature of ZoneTag. One described this group photo-taking and tagging as “a chain reaction”: “someone takes out their camera, then others take out their camera thinking something important is happening.” The other described such photo-taking as a “shared social experience” (see Quote 10).

Quote 8 (P4). [I tag] so I don’t have to explain myself – so my friends don’t have to ask me a billion questions about ‘where did you take this photo, why are you showing me this photo, who is this person in this photo’...I can give them the basic story.

Quote 9 (P11). I left reviews of places – like at the airport, when my flight was delayed, I tagged “Aloha Air sucks.”

Quote 10 (P7). It’s like digital [yawning] or something. One person pulls their [camera]phone out, and then everyone starts pulling out their camera. My use [of ZoneTag] went way up when my team started using it. ... When I’m with other friends who don’t have ZoneTag, there’s no point in using tags like that. The social dynamic isn’t as fun. ... When there is a social dynamic, my photo taking goes way up. It’s a shared social experience.

Quote 8 and Quote 9 illustrate social/ communicative motivations for tagging. Quote 10 illustrates one participant’s in-the-moment motivations for picture-taking and tagging, which occurred with other friends who use ZoneTag.

Summary of Motivations

Again, we emphasize that specific tags can play several roles in our motivation taxonomy. For example, a place-name tag can be used both for potential retrieval by the user and by others, for communicating location to others, and for reminding the user where a picture was taken at a later date. However, we found that generally, most participants only considered one or two motivations for adding tags; in many cases, they had not considered the other possible benefits.

With this in mind, we analyzed the interviews again, trying to extract the possible main motivating categories for each of the interview participants. The results are shown in Table

Sociality:	Function	
	Organization	Communication
Self	P2, P6, P10, P12 <i>P3, P8, P11</i>	<i>P1, P2, P6</i>
Social (friends/family)	P8 <i>P6</i>	P1, P4, P7, P11 <i>P6, P8</i>
Social (public)	P3, P9, P13 <i>P2, P4, P6, P7, P8, P11, P12</i>	<i>P11</i>

Table 2. Primary (bold) and secondary (italic) motivations for tagging among our 13 interview participants.

2. While we did not have enough participants to indicate significant trends, we can suggest that most of our participants were motivated to tag by organization for the general public (photo pools, search, self-promotion), with self-organization (adding tags for later retrieval) and social communication (adding context for friends, family, and the public) tied for second. The predominance of social motivations for tagging coupled with the success of tagging on Flickr suggests that adding this social dimension to tagging greatly increases the likelihood that users will tag their photos.

In Table 2, we note an interesting zigzag pattern of motivations. First, organization for oneself is a more common motivation than communication for oneself. While just over half of our participants used tags for personal search and retrieval (a motivation focused on in many previous papers on tagging), very few were motivated to tag for personal memory. However, we expect that this will be an unanticipated future benefit, even though it has not been an initial motivation for most participants. For instance, when these photos are viewed years from now, the tags can provide additional information and jog memories much the same way that captions and descriptions written on the backs of prints do today.

Second, *communication* with friends and family is a more common motivation than *organization* for friends and family (six participants vs. two). Very few participants were motivated to tag to help friends and family find their photographs; most said they would either send photos directly or found that their friends and family kept track of their photo collection as it evolved and didn’t need to use tags to search for photos. However, like personal memory described above, this may be a future benefit that is not a motivation in the present.

Finally, organization for the general public is a much more common motivation than communication. Only one participant was motivated to add contextual tags aimed at the general public (see Quote 9), and only in a few situations (giving restaurant and airline reviews), while 10 of the 13 participants added tags to make their photos publicly findable. It appears that the motivations for adding contextual tags, which tended to be very personal, are largely unrelated to the motivations for adding tags for the general public, namely, to make one’s photos findable and to gain reputation in the Flickr community.

Suggested Tags

Part of our interview focused on the ways our participants understood and used ZoneTag's suggested tags. What was the effect of the tag suggestions on the users' tagging behavior and activity? As we discovered, tag suggestions had various implications; but first, we must note the importance of the ZoneTag feature allowing users to skip tag entry on the phone.

As noted above, an early design decision in ZoneTag was to make the interaction before photo upload as burden-free as possible. In particular, ZoneTag made it possible to upload a new photo in two clicks without even looking at the settings, let alone adding or selecting tags. This 2-click upload was a welcome feature. First, many users found it difficult to enter or even select tags on the phone, especially in certain situations such as while driving or socializing. Even participants who did add tags on the phone did not always want to be interrupted in the moment of capture.

Many participants reported setting up tags once for an event and then uploading photos with the same tags without having to interact with the tagging interface after each photo. In Quote 12, the participant liked that previously-used tags showed up (though a few participants reported accidentally adding tags they didn't intend to add because of this feature). In Quote 11 the participant modifies the way he tags, knowing that others will see his tags as suggested tags when they are in the area. Many participants also used the auto-completion feature extensively (*e.g.* see Quote 12).

The function of the suggested tags was clear for most, but not all, of our users. Some participants commented about the quality of the suggestions. One said that ZoneTag worked great when she was attending a conference with other ZoneTag users who created local tags: "I thought, great! This is how I want it to work all the time!"

On the other hand, we found that tag suggestions sometimes did not work well. In particular, since the system cannot distinguish different types of tags, unknown person names entered by another user near the same location sometimes appeared in the tag list, thus confusing some participants. One participant commented about an unfamiliar name, "This person was in my phone for a month! Who is she?"

We also learned that suggested tags served a broader

Quote 11 (P13). I was taking a picture of the water tower in Sunnyvale, and I thought about how my tags would show up for others. ... Tag suggestions were huge for me; they really cut down on typing.

Quote 12 (P2). I appreciate the fact that I can reuse the tags. It makes it worth my while. ... I try to use as many suggested tags that apply. ... I also use it for auto-completion – I type "s" to get San Francisco.

Quote 11 and Quote 12 illustrate the usefulness of suggested tags. All participants reported liking the system, even when they didn't fully understand it.

purpose that simply aiding in tag entry. First, some participants had become used to scanning the tag suggestions to add any tags that may be relevant, even if they did not mean to add them in the first place. One participant described how he scrolls down the list and selects available tags simply because they are present. Less helpfully, some participants stated they add such tags even if they are not entirely relevant or accurate.

Second, the suggested tags, even when not selected, inspired some participants to add their own tags and gave them direction as to the sorts of tags they should use (*e.g.*, seeing other neighborhood names as suggested tags could encourage the user to add a tag for their neighborhood as well).

To summarize, ZoneTag's tag suggestions have had a large impact on the participants' tagging activity. However, the option to bypass tags altogether was an important feature for the usability of the system as a whole.

IMPLICATIONS

Our observations and analysis of user motivations in the Flickr/ZoneTag system allow us to draw implications for the design of photo sharing, annotation, and organization applications, as well as for tagging systems in general.

- Make the annotation pervasive and multi-functional, and incorporate motivations in all four categories of the taxonomy. For example, tags or captions created by the user for a photo on a desktop photo application should be displayed, and made searchable, in web albums where the photo is published, or in email messages sent with it.
- Make it easy to annotate when the information (photos, in this case) is captured. The higher rates of annotation in ZoneTag than in Shozu (where it is more difficult to tag) or Flickr (where tagging takes place after-the-fact) show that easy annotation at the point of capture seems to increase tagging activity (also see [22]).
- However, do not *force* users to annotate at the point of information capture. The system will become unusable for people who would not annotate [13]. In mobile conditions, even users who are inclined to annotate would not always be able to.
- For systems that have both mobile capture and desktop/web based components, allow annotation in both settings: leverage the fast entry and powerful tools of the desktop to allow more descriptive or bulk annotation, and the in-the-moment aspect of mobile devices to remind users that they could take a moment to annotate now.
- Relevant tag suggestions, even when not used directly, can encourage tagging and give users ideas about possible tags. However, suggestions should be used with caution. First, users may be confused or alarmed by inexplicable tags. Second, users may just choose these tags even if they are not immediately relevant to the content instead of manually entering more accurate tags.

CONCLUSIONS

The topic of content annotation has been an important research area in the field of human computer interaction. We conducted qualitative studies in a real-world system where users annotate their data – in this case, photos. The interviews, although focused on a narrow set of users, showed that more than one set of motivations comes into play when users tag their photos. We hypothesize that having these multiple motivations is a determining factor in users' decision to annotate. In particular, social incentives for tagging appear to be surprisingly important in motivating users to tag their photographs.

Under these conditions, we showed that it is possible to motivate users to annotate content. Point-of-capture annotation (*e.g.*, on the mobile device) can encourage the addition of tags. Tag suggestions and other methods of assisting mobile annotation proved to have broader implications than just assistance in text-entry. In some cases, the suggestions can inspire users to tag their photos and give them guidance for how best to annotate. Based on our observations, we believe that people are more inclined to tag their content when they are given the right incentives and affordances for annotation.

FUTURE WORK

The taxonomy of tagging motivations would benefit from additional data from more ZoneTag users over a longer period of time, especially as ZoneTag is incorporated into more users' daily practice. In particular, we would like to follow up on emergent practices among groups of friends who all use or are familiar with ZoneTag, including real-time collaborative tagging and the incorporation of reviews, inside jokes, and ad-hoc photo collection coordination into tags. We would also like to test the taxonomy on additional Flickr tagging data as well as on other tagging systems.

ACKNOWLEDGMENTS

First and foremost, we would like to thank our participants for their cooperation and patience. We would also like to thank to Shane Ahern and the rest of the ZoneTag team at Yahoo! Research Berkeley for their assistance. Vlad Kaplun developed the Flickr photo-elicitation tool, based on the tool developed in [23]. Finally, Mirjana Spasojevic, David A. Gibson, and Ka-Ping Yee provided invaluable comments on early drafts of this paper.

REFERENCES

1. Flickr, <http://www.flickr.com>
2. Frohlich, D., Kuchinsky, A., Pering, C., Don, A., and Ariss, S. Requirements for Photoware. In *Proc. CSCW '02*, ACM Press (2002).
3. Girgensohn, A., Adcock, J., Cooper, M., Foote, J. and Wilcox, L. Simplifying the Management of Large Photo Collections. In *Proc. INTERACT '03*. IOS Press (2003).
4. Golder, S., and Huberman, B.A. The Structure of Collaborative Tagging Systems. Tech. Report, HP Labs, 2005.
5. Kang, H., and Shneiderman, B. Exploring Personal Media: A Spatial Interface Supporting User-defined Semantic Regions. Tech. Report ISR 2005-51, U. Maryland, 2005.
6. Kindberg, T., Spasojevic, M., Fleck, R. and Sellen, A. The Ubiquitous Camera: An In-Depth Study of Camera Phone Use. In *IEEE Pervasive Computing* 4, 2 (2005), 42-50.
7. Kirk, D.S., Sellen, A.J., Rother, C., and Wood, K.R. Understanding Photowork. In *Proc. CHI '06*, ACM Press (2006).
8. Kuchinsky, A., Pering, C., Creech, M.L., Freeze, D., Serra, B., and Gwizdka, J. Fotofile: A Consumer Multimedia Organization and Retrieval System. In *Proc. CHI '99*, ACM Press (1999).
9. Kules, B., Kang, H., Plaisant, C., Rose, A., and Shneiderman, B. Immediate Usability: Kiosk Design Principles from the CHI 2001 Photo Library. Tech. Report CS-TR-4293, U. Maryland, 2003.
10. Kustanowitz, J. and Shneiderman, B. Motivating Annotation for Personal Digital Photo Libraries: Lowering Barriers while Raising Incentives. Tech. Report HCIL-2004-18, U. Maryland, 2005.
11. Marlow, C., Naaman, M., boyd, d., and Davis, M. HT06, Tagging Paper, Taxonomy, Flickr, Academic Article, ToRead. In *Proc. Hypertext '06*, ACM Press (2006).
12. Marshall, C. Toward an Ecology of Hypertext Annotation. In *Proc. Hypertext '98*, ACM Press (1998).
13. Naaman, M., Paepcke, A., and Garcia-Molina, H. From Where to What: Metadata Sharing for Digital Photographs with Geographic Coordinates. In *Proc. CoopIS '03*, ACM Press (2003).
14. Naaman, M., Yeh, R.B., Garcia-Molina, H., and Paepcke, A. Leveraging Context to Resolve Identity in Photo Albums. In *Proc. JCDL '05* (June 2005).
15. Okabe, D., and Ito, M. Everyday Contexts of Camera Phone Use: Steps Toward Technosocial Ethnographic Frameworks. In *Mobile Communication in Everyday Life: An Ethnographic View*, forthcoming.
16. Rodden, K. How do People Organise their Photographs? In *BCS-IRSG Colloquium on Information Retrieval*, 1999.
17. Rodden, K. and Wood, K. How Do People Manage Their Digital Photographs? In *Proc. CHI '03*, ACM Press (2003).
18. Salovaara, A., Jacucci, G., Oulasvirta, A., Saari, T., Kanerva, P., Kurvinen, E., and Tiitta, S. Collective Creation and Sense-Making of Mobile Media. In *Proc. CHI '06*, ACM Press (2006).
19. Sarvas, R., Herrarte, E., Wilhelm, A., and Davis, M. Metadata creation system for mobile images. In *Proc. MobiSys '04*, ACM Press (2004).
20. Sen, S., Lam, S.K., Rashid, A.M., Cosley, D., Frankowski, D., Osterhouse, J., Harper, F.M., Riedl, J. tagging, communities, vocabulary, evolution. In *Proc. CSCW '05*, ACM Press (2005).
21. Shneiderman, B. and Kang, H. Direct Annotation: A Drag-and-Drop Strategy for Labeling Photos. In *Proc. INFOVIZ '00*, May 2000.
22. Van House, N., Davis, M., Ames, M., Finn, M., and Viswanathan, V. The Uses of Personal Networked Digital Imaging: An Empirical Study of Cameraphone Photos and Sharing. In *Ext. Abstracts CHI '05*, ACM Press (2005).
23. Van House, N. Interview Viz: Visualization-Assisted Photo Elicitation. In *Ext. Abstracts CHI '06*, ACM Press (2006).
24. von Ahn, L. and Dabbish, L. 2004. Labeling Images with a Computer Game. In *Proc. CHI '04*, ACM Press (2004).
25. Wenyin, L., Dumais, S., Sun, Y., Zhang, H., Czerwinski, M., and Field, B. Semi-automatic image annotation. In *Proc. INTERACT '01*, IOS Press (July 2001).