What Drives Content Tagging:
The Case of Photos on Flickr

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ABSTRACT

We examine tagging behavior on Flickr, a public photo-sharing website. We build on previous qualitative research that exposed a taxonomy of tagging motivations, as well as on social presence research. The taxonomy suggests that motivations for tagging are tied to the intended target audience of the tags – the users themselves, family and friends, or the general public. Using multiple data sources, including a survey and independent system data, we examine which motivations are associated with tagging level, and estimate the magnitude of their contribution. We find that the levels of the Self and Public motivations, together with social presence indicators, are positively correlated with tagging level; Family & Friends motivations are not significantly correlated with tagging. The findings and the use of survey method carry implications for designers of tagging and other social systems on the web.

Author Keywords

Tags, Flickr, photo sharing, motivations, social presence.

ACM Classification Keywords

H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION

Tagging, or using keywords in order to add metadata to content [5], is gaining much popularity in recent years [3,5,11]. Tagging is used to annotate various types of content, including images, bookmarks, blogs, and videos, through web-based services such as Flickr, del.icio.us, Technorati, and YouTube, respectively. The importance and popularity of tagging are attributed, at least in part, to the benefits users gain from effective sharing and organization of very large amounts of information [2,3,11].

Users' motivations for tagging on Flickr, a public photo-sharing website, were explored qualitatively by Ames and Naaman [2]. In their study, the researchers drew the distinction between motivations stemming from three categories of target audience for the tags added by the user. These categories include: *Self, Family & Friends*, and the general *Public* of Flickr users. Within each category, the researchers identified two functional dimensions for tagging, representing the tag's intended use: *Organization* and *Communication*. *Organization* is tied to categorization and future retrieval of images, while *Communication* involves providing additional context to viewers of the image. For example, in the *Self* category, the *Organization* function is intended to facilitate future search and retrieval by the user, and the *Communication* function involves adding context to the image for the user's own future recall or understanding (e.g., "where did I take this photo?"). In the *Public* and *Family & Friends* categories, the *Organization* function is intended to facilitate future search and retrieval by others; the *Communication* function reflects the motivation to add information that explains the image and its context to viewers. For convenience, refer to the taxonomy below in Figure 2 (where we use the taxonomy to develop our survey items).

The findings of [2] suggest that *social presence* plays a role in tagging behavior. According to social psychology research, behavior is affected by presence – actual, imagined, or implied – of others [1]. The effect of perceived social presence was found to exist even when such presence was computer mediated (e.g., [10,12]). Perceived social presence was also found to have a positive effect on tagging in del.icio.us, a bookmark managing system in which tagging is used extensively [8]. Indeed, creating social presence is seen as key to developing successful virtual (computer-mediated) communities [7]. In the taxonomy of [2], the *Public* and *Family & Friends* motivations would not exist without the user's awareness of other people in the system who might be viewing the user's images.

Flickr has various avenues through which a user seeks and perceives social presence. In this study, we look at two indicators of social presence: groups and contacts. A Flickr user can belong and post photos to multiple user groups, which are normally formed around a common subject of interest (e.g., trains, Chicago). In addition, a Flickr user can designate other users as "contacts," people whose photos the user follows (contacts are often reciprocal). By marking certain contacts as "friends" or "family," a user may provide

these contacts with a special access for to his semi-private photos. When a user joins a group or adds people to his contact list, the user implicitly accepts that his images will be exposed to members of the group or the user's contacts, thereby leading to a perception of social presence, and possibly affecting the user's tagging behavior.

In this work we present a quantitative study which builds on the findings of [2], and which allows us to explore the effects of the various motivations and social presence on actual tagging behavior on the Flickr site.

The contributions of this work include: a) a research model capturing the effect of user actions, motivations, and social environment on tagging; and b) a first quantitative study of tagging motivations on the photo-sharing website Flickr.

We begin by laying out the hypotheses, and then describe the study method and results.

RESEARCH MODEL

Since we are studying tagging behavior, the dependent variable we measure is the total number of unique tags applied by users to images in their Flickr photo collection. We expect to see evidence that this dependent variable is influenced by both stated user motivations, and by social presence indicators, representing the user's perceived social presence on Flickr.

Based on Ames and Naaman's findings [2], we would expect to find the following:

H1: The level of users' *Self* motivation will be positively correlated with their number of tags.

H2: The level of users' *Public* motivation will be positively correlated with their number of tags.

H3: The level of users' *Family & Friends* motivation will be positively correlated with their number of tags.

We further hypothesize that indicators of social presence on Flickr will be correlated with the number of tags, as previously shown for other systems [8], and as suggested by the Public and Family & Friends tagging motivations [2]. This view is supported by evidence that users' viewing activity is affected by the number of their contacts [9]. Since on Flickr, groups and contacts can be taken to imply perceived social presence, we would expect the following:

H4: The number of contacts a user has will be positively correlated with the user's number of tags.

H5: The number of groups in which a user is a member will be positively correlated with the user's number of tags.

Another potential driver of tagging, which serves as a control variable, is the level of participation, as evident by the number of images a user has in their Flickr account. Regardless of other motivations and social factors, a larger number of photos introduces both an opportunity and a more pressing need for a user to tag their photos. We expect, then, that the more photos in the user's account, the more tags he

or she will have. Controlling for the number of images is therefore critical for understanding the other factors that influence tagging behavior. Notice that although the duration of the user's activity on Flickr may also serve as a control variable, we feel that the number of photos in the user's account is a more direct measure. To confirm this, both control variables can be tested.

To summarize, our research model attempts to explain tagging activity using three elements: stated motivations (*Self*, *Family & Friends*, *Public*), social presence indicators, and participation level. The model is described in Figure 1.
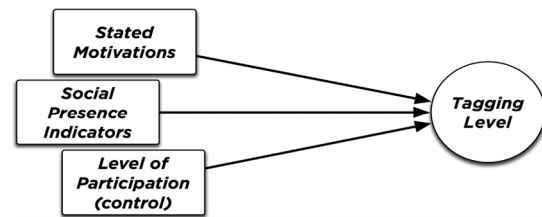

Figure 1. Summary of the research model

METHOD

In recent years there has been an increasing use of surveys in the HCI field (e.g., [4,6]). However, much of the research on users' tagging motivations so far has been qualitative, and therefore provides a useful conceptual background but no statistically significant quantitative assessment of the motivations.

In this study, we execute a larger-scale study of tagging on Flickr, using independent sources: user-reported data (via a survey) and Flickr system data about actual usage. Using system data is a suggested approach for avoiding *common method bias*, which often poses a methodological problem in interpreting results from survey studies [13], and can be avoided by measuring the dependent variable using objective data. In this study, users' tagging data was retrieved from the Flickr system, and therefore common method bias should not arise in interpreting our results.

To measure the effects of different tagging motivations, we have developed a scale based on Ames and Naaman's qualitative work [2]. The scale includes three constructs, representing the three categories of intended users of the tags, as perceived by the user: *Self, Family & Friends*, and *Public*. For each construct, we included questionnaire items representing both the communication and the organization functions (we did *not* design the study to differentiate between these functions). All of the motivation items in the questionnaire were presented as statements to which users were asked to state how strongly they agree, on a scale of 1 to 7; figure 2 contains examples of such questionnaire items. After the preliminary scale was developed, a pilot study (N = 193) was carried out to validate the scale. An exploratory factor analysis using principle component analysis (PCA) was carried out and resulted in a three-factor solution. Items showing factor loading higher than 0.6 and cross-loadings lower than 0.4 were retained, and others were dropped. The

retained items were then subject to another exploratory factor analysis which showed satisfactory factor loadings for all items. In addition, each of the three constructs showed at least a 0.8 Cronbach's alpha, indicating good reliability. The final scale contains 4, 6, and 6 items for *Self*, *Family & Friends*, and *Public*, respectively, and was used in the survey.

	Organization	Communication
Self	"When I tag my Flickr photos I make it easier for myself to find my photos later."	"When I view my photos on Flickr and try to recall where and when they were taken, it's useful if I tagged them earlier."
Friends and Family	"When my friends or family search in my Flickr photos, it is easier for them if I tagged these photos earlier."	"Tagging is a way for me to describe my photos to my friends or family."
Public	"When I tag my photos I make it easier for other Flickr users to find my photos."	"Tagging is a way for me to provide details about my photos to other Flickr users."

Figure 2. Sample questionnaire items, broken by the two-dimensional (target and function) taxonomy of motivations for tagging from [2].

Actual usage information for the participants was retrieved directly from the Flickr data services. System data such as users' number of photos or tags is available via the Flickr system's Application Programming Interface (API). The Flickr API allows third party services to communicate with Flickr and access the user's data (often requiring the user's permission). At the end of our web-based survey, respondents were asked to authorize our web service to access their Flickr account information. This way, Flickr data about the respondents who logged in was automatically extracted and recorded together with the participant's response to the questionnaire.

We retrieved several key data for each participant from Flickr (if available via the API) or the users themselves (if not). To measure social presence we extracted the number of groups to which a user belongs and the number of contacts a user has. We also retrieved the number of photos in a user's account, and the number of unique tags in their account. Other than the number of groups, all these data are extractable via the Flickr API.

Since we were interested in tagging behavior, we only approached users who had used at least 5 unique tags, thus ensuring that we get data from users whose tagging was not an isolated, unrepeated experience. In addition, since we had no access to photos designated as private, we only approached users who had at least one public photo on Flickr. We also only approached users who tagged in English, to ensure that respondents understand the survey questions. We contacted a random sample of users, selected from a page of photos uploaded recently to Flickr, and emailed 1373 users an invitation to participate in the web-based survey. A total of 237 valid responses were received, representing a 17.1% response rate, much in line with similar studies. The average respondents' age was 35.5 (median = 32), and 54.3% of the respondents were male.

SUMMARY OF FINDINGS

An analysis of the data reveals a diverse set of users. The number of unique tags varied greatly across users (see Figure 3). On average, respondents used 370 unique tags (median = 149, standard deviation = 634.9). The average number of photos in the participants Flickr account was 2118 (median = 802, stdev = 6529.7). On average, respondents had 30 contacts (median = 10; stdev = 64.4,) and belonged to 26 groups (median = 5, stdev = 64.6).
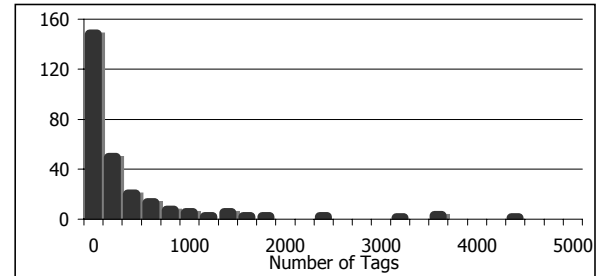

Figure 3. Histogram of number of unique tags

Figure 4 describes the findings. Overall, our model, combining stated motivations, social presence indicators and the control variable of number of photos, explains 57.1% of the variance in user tagging behavior.

We found that the levels of the *Self* and *Public* motivations, as well as the social presence indicators and the number of photos, were positively correlated with tagging level. In other words, Hypotheses 1, 2, 4 and 5 were supported. For example, The *Public* motivation is significantly correlated with the tagging level, and explains 2.25% ($.150^2$) of the variance in it. The *Family & Friends* motivation, on the other hand, was found not to be significantly correlated with tagging level. Given the skewness of the data, the model was tested after outliers were removed, and similar results were found. In addition, the model was tested with the duration of users' activity on Flickr as another control variable, and similar results were found.
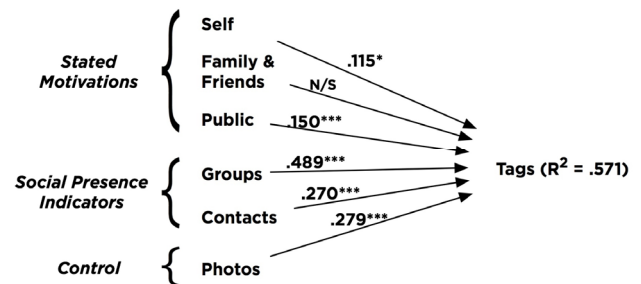

Figure 4. Regression results (N = 237)
*significant at 0.05 level **significant at 0.01 level ***significant at 0.001 level

Why was no relationship found between the *Family & Friends* motivation and tagging level? A possible explanation can be found in the interviews conducted by Ames and Naaman [2]. The authors suggest that for the *Family & Friends* target of tagging, the Organization function was a relatively weak motivation; the stronger motivation stems

from the Communication function (in other words, users added tags to *describe* images to family and friends, not to help them find images). The Communication function on Flickr is served by other means that pose an alternative to tagging (e.g., titles, captions, and sets). In addition, users may communicate about the photos to their friends via other, external means (e.g., email). These factors could potentially explain the lack of correlation between the *Family & Friends* motivation and the number of tags.

IMPLICATIONS AND CONCLUSIONS

Given the growing use of tags as means of facilitating the sharing and organization of large amounts of information [3,11], designers and leaders of content sharing systems need to understand what motivates users to tag, and which motivations are associated with increased tagging. The sustainability of online communities depends on members' stimulation [7]; for example, viewing activity is critical for the sustainability of content sharing communities [7], and tagging can contribute to increased viewing for the user's content. Enhancing users' tagging (by encouraging the factors that give rise to it) may contribute to the success of such communities.

By basing our survey on the results of a qualitative study [2], our study benefits from the advantages of both qualitative research and quantitative research: the insights gained from the users' interviews [2] now received statistically-significant empirical support and refinement, and their generalizabilty is much enhanced.

Our study exposes the different factors that contribute directly, and quantifiably, to tagging activity on Flickr. The findings of the study suggest two of the three stated motivation categories affect users' tagging level, and that social presence, made available due to the different ways in which relationships among users are manifested, has a more powerful effect on tagging.

The results have implications for practitioners in social media. Assuming that the correlations found also involve causality, it is advised that managers of collaborative content systems seeking to increase tagging activity focus their communication and marketing efforts on those factors that have a strong impact on tagging level. For example, the Public-driven motivation of tagging has a positive, if small, effect on tagging level. Therefore, it might make sense for organizers of content systems to expose the fact tagging may help the user's content to be discovered.

In line with findings from research on other content sharing systems [8], social presence proved to have a positive effect on tagging in our study. Organizers of existing content-sharing systems could focus efforts in this area as well, by exposing users to the benefits of designating contacts and joining groups that fit the users' interests. In addition, it is advised to design new content sharing systems in ways that maximize the opportunities for social presence, and expose the effects of joining groups and adding contacts.

Further research may help in understanding how different motivations impact contribution in different content sharing systems. This work – addressing Flickr, a prominent photo sharing system – is a step in this direction.

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