Personal Information Management vs. Resource Sharing: Towards a Model of Information Behaviour in Social Tagging Systems

Markus Heckner
Accenture
markus.heckner@accenture.com

Michael Heilemann
Educational Science
University of Regensburg
michael.heilemann@
paedagogik.uni-regensburg.de

Christian Wolff
Media Computing
University of Regensburg
christian.wolff@computer.org

Abstract

Social tagging systems allow users to upload and assign keywords to digital resources. Thus a body of user annotated resources gradually evolves: Users can share resources, re-find their own resources or use the systems as search engines for items added by the whole user population. In this paper we want to contribute towards a better understanding of usage patterns within social tagging systems by presenting results from a survey of 142 users of the systems *Flickr*, *Youtube*, *Delicious* and *Connotea*. Data was gathered partly by using the *Mechanical Turk* service, and partly via an announcement on the *Connotea* blog. Our study reveals differences of user motivation and tag usage between systems. While (resource) sharing emerges as an all-embracing intra-system motivation, users differ with respect to social spheres of sharing. Based on our results which we integrated with earlier research from Cool and Belkin (2002), we propose a model of information behaviour in social tagging systems.

Introduction

Research on social tagging has recently developed from mere statistical analyses towards studies that aim to contribute towards a better understanding of functional aspects of user keywords (cf. e.g. Kipp and Campbell, 2006, Heckner, Mühlbacher, and Wolff, 2008 and Heckner, Neubauer, and Wolff, 2008).

It largely remains an open question how and why people use social bookmarking services. A reflection on tagging and bookmarking practices can be found in Udell (2007). Finding one's own items again (as an aspect of *personal information management*) and sharing items with others seem to emerge as possible goals for system users as argued in Heckner, Neubauer, and Wolff (2008). This distinction between information sharers and information managers has also been recognized by Thom-Santelli, Muller, and Millen (2008): For example, the roles they describe as *Evangelists* and *Publishers* represent information sharers. However, personal information management is only described as a sub-motivation underlying all user roles. Also, the underlying motivation of users can be assumed to affect the resulting tags. This is especially important, since not all tags are equally well suited for information retrieval (Bischoff et al.

2008). Previous research has focussed on analysing tag usage without direct connection with the original tag creators whose tagging motivation thus remains unclear.

Social tagging has also been discussed in the context of information retrieval as a possible solution to the *vocabulary problem* stated by Furnas et al. (1987) and others: Tags offer multiple descriptions of a given resource, which potentially increases the likelihood that searcher and tagger find a common language and thus retrieval effectiveness may be enhanced. Additionally, Larsen, Ingwersen, and Kekäläinen (2006) speculate about increased retrieval performance when more metadata is available (*polyrepresentation hypothesis*). Recently, user-based evaluations of retrieval systems have come into focus (cf. Voorhees, 2002).

Consequently, this paper aims to reveal user intentions by interviewing them about their usage patterns (uploading, tagging and retrieving) and intentions behind using social tagging systems like *Connotea*, *Delicious*, *Youtube* and *Flickr*. Results from our study are reported, followed by a model of information behaviour in social tagging systems. Finally, connections to previous research concerning tagging and bookmarking practices are drawn and implications for future search systems are briefly discussed.

The Potential Ease of Tagging

Categorization and tagging begin after an item of personal interest has been considered worthy of being included in the user's personal collection. When users are faced with the task of categorizing email into folders or saving files, several concepts are activated in the human mind (for an email these might be task-oriented concepts (e.g. *urgent, print*) or subject-oriented categories (e.g. *IR paper, WWW conference*)). However, feelings of anxiety may occur when users have to select one and only one of the activated concepts and store the file or email at the selected place: Without creating duplicates, email messages or files can only reside in one folder in single hierarchy file systems. The categorization decision is further complicated by the fact that users have to decide at the moment of categorization which category is the right one to ensure future "findability". This situation can lead to what (Sinha 2005) describes as "post activation analysis paralysis" (cf. figure 1).

Social tagging can help liberating users from "post activation analysis paralysis" since they are free to choose as
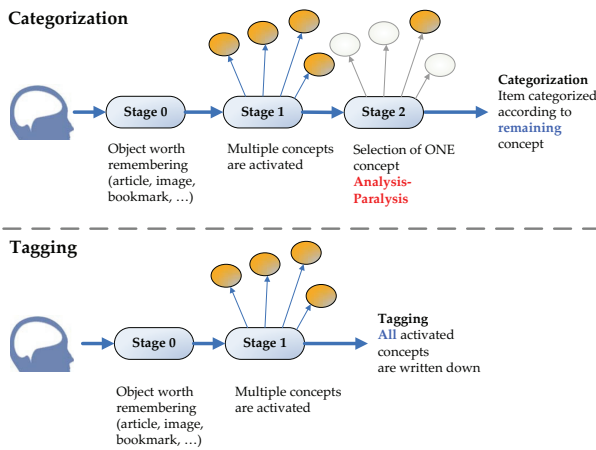
Figure 1: Cognitive processes behind tagging and categorization (Sinha 2005)

many categories as they like. Users do not fear that they have made the wrong categorization decision and that they will never find the item again: They can write down all the activated concepts, since most social tagging systems allow users to assign an unlimited number of free text tags to the resource. Consequently, since no possibilities are ruled out, users cannot develop the fear of classifying wrongly or only partially correct.

Previous studies have attempted to assess the potential of tags as a means for classification that goes beyond content description: Heckner, Mühlbacher, and Wolff (2008) have identified *label tags*, which they believe have functions beyond mere content description and are only meaningful to the tagging user or to a limited number of other users (e.g. *Imagingvis*, *hb1*, *958*). Also, Strohmaier (2008) describes *purpose tags* which denote non-content specific functions that relate to an information seeking task of users (e.g. *learn about LaTeX*, *get recommendations for music*, *translate text*). However, problems arise when analysing tag functions without directly interviewing users: The properties of the tags and their functions are a direct function of the taggers' intentions which remain hidden when only focussing on tag data alone. Consequently, this study attempts to shed some light on underlying user motivations. The systems studied in this paper are social software tools that allow users to upload and tag different types of digital media: *Flickr* is largely used for uploading photos, *Youtube* supports video files, *Delicious* is used to bookmark webpages and *Connotea* is intended as a reference management and sharing service for academic papers.

Tagging Motivations: Personal Information Management vs. Resource Sharing

We propose that the intentions of tagging users can roughly be assigned to two functional areas: *personal information management* (= PIM) (Lansdale, 1988, Boardman and Sasse, 2004 and Teevan, Jones, and Bederson, 2006) and *resource sharing*. The first group of users wants to manage a

personal collection of digital items to keep items findable for later use (= personal information management with strong *information retrieval* aspect). The second group is at least partly motivated by their peers in a community. This type of users wants to share digital resources so that they can be discovered by other people than themselves (strong *reputation* aspect).

Personal Information Management and Social Tagging Systems

More and more people are using the WWW for almost any conceivable task. Shopping, booking flight or train tickets and many more tasks can be carried out with a computer connected to the web. At the same time, users are increasingly reliant on web-based information in their daily job routines. One problem of information retrieval is re-finding information that has already been discovered: In a study exploring personal information management on the web Jones, Bruce, and Dumais (2001) report different strategies for re-retrieval.
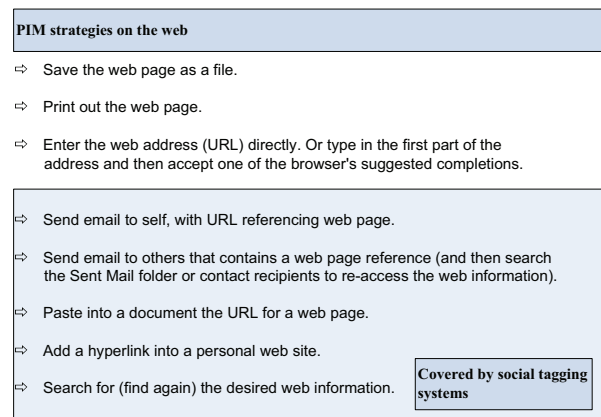

Figure 2: PIM strategies in the context of social bookmarking systems

Figure 2 gives an overview of PIM activities that can be carried out in the context of social tagging systems.

While web browsers' bookmarking features are a typical solution for organizing past browsing experience, according to Jones, Bruce, and Dumais (2001), people use this feature remarkably infrequently. The following list presents the inadequacies of browser bookmarks and their potential solutions provided by social tagging systems:

- Hard decisions when creating and naming folders: A bookmark can only reside in one folder, consequently the user has to make a classification and selection task: *Tags free the users from classification problems (see above).*

- Limited availability and access points: Browser bookmarks are stored locally and are accessible either from home or work: *Web-based social tagging platforms residing on WWW servers provide access points from anywhere (where web access is available).*

- Limited contextual information: Apart from folder and bookmark name, no contextual information is available:

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Tags can serve as additional contextual information and specify item contents more precisely.

- Communication and information sharing: Locally stored bookmarks cannot be shared with friends or colleagues without using alternative strategies like email: *Tagging systems provide permanent storage and access points for all users.*

Resource Sharing

Sharing does not imply any notion of personal re-findability and personal information management. For exmaple, a video is not primarily stored on *Youtube* to be found again for later viewing. Severe restrictions on video length (maximum of 10 minutes) and quality (low resolution) support this assumption. Rather it can be assumed that *Youtube* users want other users to find the videos they consider to be funny or original. In Heckner, Neubauer, and Wolff (2008) a phenomenon has been observed which may be referred to as "overtagging", where users assigned a relatively large number of tags (greater than 10) to a single resource including many synonyms and spelling variations.

In the following, we claim that user motivations of social tagging platforms differ with respect to information management or information sharing. A user who posts and annotates an item to the *Delicious* database might primarily be interested in describing the resource for personal re-findability. This is backed by Rader and Wash (2008) who have shown that tags assigned by *Delicious* users reflect a tendency towards personal information management. A *Youtube* user on the other hand is potentially interested in sharing his items and thus describes uploaded videos in a way so that they can be more easily discovered by other users.

Methodology

In this study, the Amazon *Mechanical Turk* service (`http://www.mturk.com`) is employed for recruiting tagging users. This service offers a small monetary reward for people willing to fulfill *human intelligence tasks* (HITs) which cannot be automatically performed by a computer. Among typical *MTurk* HITs are annotating media for gathering classification training data or text production (writing abstracts or resumés) as well as questionnaires as in our case. The arguments for using this service are:

1. Mechanical Turk surveys are comparatively cheap, even with limited financial resources it becomes possible to create medium scale surveys incorporating more than one hundred test subjects.

2. It is of vital importance to reach real users of social tagging platforms and to question these users about their intentions. Acquiring large user numbers from diverse tagging systems is hardly feasible for an explorative study.

In our study, participants were required to have at least signed up an account on the respective systems for 6 months and additionally have a collection of at least 20 digital items or resources (5 in the case of *Youtube*) in their collections. This can only be judged by post-interview

heuristics analysing questionnaire data. In addition, concerns of limited data validity are justified, as *Mechanical Turk* users do not represent a random sample from the population of all tagging system users. However, using post interview checks for plausibility only a very small number of dubious questionnaires had to be sorted out (< 5). At the same time, we were not able to attract a significant number of *Connotea* users from the population of *Mechanical Turk* users. Instead, *Connotea* users were recruited with a call for participation in a research project, posted by *Connotea* staff on the site's blog (see `http://network.nature.com/people/ianmulvany/blog/2008/12/19/request-for-participation-in-research-survey`).

All users were presented with a survey where they had to respond to a list of questions mostly by expressing their agreement or disagreement on a 7 point *Likert scale* (7 = complete agreement, 1 = complete disagreement). In addition, participants had to describe their most recent use of the respective systems, thus employing the *critical incident technique* (cf. Flanagan, 1954). Free text comments about general aspects of the systems were collected as well.

Participants and Tagging Systems

142 participants (68 female, 71 male and 3 unspecified) took part in the survey. The 142 participants were distributed as follows: 48 *Flickr* users, 47 *Youtube* users, 32 *Delicious* users and 15 *Connotea* users. Age distribution was as follows: 18-25 (66), 26-35 (46), 36-45 (20), 46-55 (9), 56 and above (1). The majority of users (82) claims that they use other social bookmarking systems, while 60 users state that they do not use any other systems.

Flickr, *Youtube*, *Delicious* and *Connotea* were selected because they represent a broad spectrum of resource types and users. Resource types range from images, videos, browser bookmarks to scientific papers. While *Youtube* is arguably mostly used in an entertainment or leisurely context, *Connotea* has a scientific professional background. We believe that this selection covers a rather wide spectrum of information behaviours.

Results

Intentions for Using Social Tagging Systems

One goal of the study is to determine whether users of social tagging systems use the platforms for purposes of personal information management or for information sharing. Personal information management was measured with two items (Cronbach's alpha .801), information sharing was measured with three items (Cronbach's alpha .72).

A one-way ANOVA was used to test for differences of user motivations among the systems. Motivation for personal information management differs significantly across the four systems, $F (3, 137) = 6.65$, $p = .00$. Sharing motivation also differs significantly, $F (3, 137) = 2,78$, $p = .04$.

Specifically a Tukey post-hoc test for sharing revealed that *Delicious* ($M = 4.63$) differs significantly from *Youtube* ($M = 5.67$). The other systems do not differ significantly for

the sharing motivation. For personal information management, *Youtube* (M = 4.95) differs significantly from all other systems (*Flickr M = 5.61 , Delicious M = 6.05, Connotea M = 5.87*). It appears that for *Youtube* users, personal information management is a less motivating factor than for users of all other systems (a comparison of mean values can be found in figure 3).
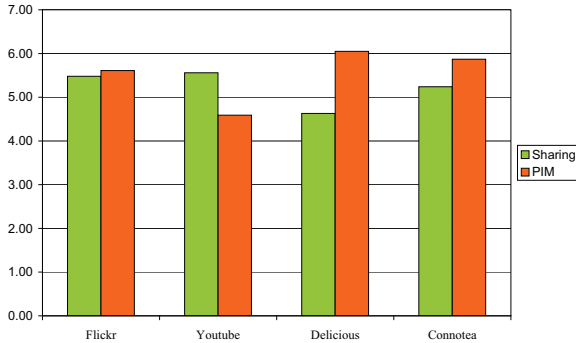

Figure 3: Personal Information Management vs. Sharing

However, when questioned about their intention the last time they were uploading an item according to the critical incident technique (cf. Flanagan, 1954) users answered differently: *Flickr* and *Youtube* users show strong tendencies towards sharing. Interestingly, and against our initial asumptions, several *Youtube* users claimed motives of PIM for adding an item to their collection. Some actual examples of this unexpected behaviour of *Youtube* users are given in table 1.

"To bookmark a music video for a song I particularly love."
"The video added to my collection was done because I liked the video and didn't want to have to search for it amongst others. This makes it easier for me to find the videos I think are cute funny, or have a good meaning."

Table 1: Examples for PIM motives in *Youtube*

Very notably, from our analysis of free text comments (qualitative analysis), no intentions other than PIM and sharing can be identified (distribution see figure 4). For several users both PIM and sharing emerge as parallel sources of motivation.

From the comments a specific and targeted sharing motive emerges: For example, users stated that they use the system for making the resource publicly available and that they subsequently send an email to one specific person that contains the URL as a pointer to the uploaded resource. 63% of all users, irrespective of the system they use, responded that they have previously informed someone about items they find interesting by sending them a URL to their item collection or to items tagged with a specific term. This is especially noteworthy in the context of the social web, since ease of publication and sufficient bandwidth have enabled users
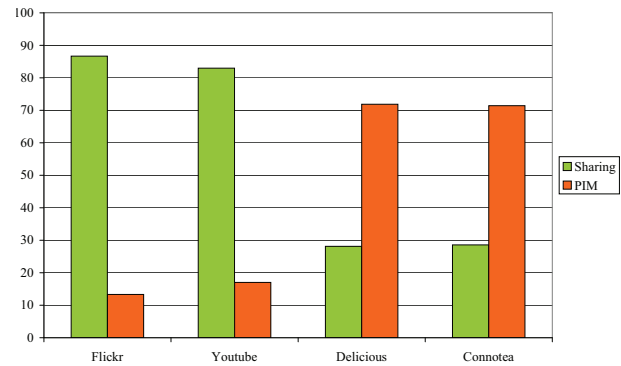

Figure 4: User motivations emerging from qualitative judgements

to pursuit this strategy: "*the last time I uploaded a picture to flickr it was so I could e-mail my mom the link to it so she could see a picture of my sister-in-law's new puppy. I prefer using flickr rather than just emailing the file because it's quicker. My email takes a really long time to attach files, while flickr only takes a few seconds.*"

5 *Flickr*, 2 *Youtube* and 2 *Delicious* users claim that they use the respective system as an item repository for embedding resources in their blogs or webpages (cf. table 2).

"To upload it onto a website in order to show the item in the photo to an online community." (*Flickr*)
"I had an article posted on a blog and wanted to increase its visibility. The tagged articles also show up on my Facebook page." (*Delicious*)

Table 2: Examples for using the systems as item repository

The comments from table 3 exemplify the sharing motive for *Flickr* and *Youtube* users.

"I uploaded images of my progress on a long distance driving trip, to keep my friends and family updated on that progress." (*Flickr*)
"I just wanted to add pictures which can prove useful for others as wallpapers." (*Flickr*)
"I uploaded a movie about my nephew to share with my other relatives." (*Youtube*)
"To share a video of my daughter's piano recital with family who were not able to be there." (*Youtube*)

Table 3: Sharing intention in *Flickr* and *Youtube*

The focus on PIM is reflected in the comments from *Delicious* and *Connotea* users (cf. table 4).

Personal information management is more prevalent for *Delicious* and *Connotea* users. The results conform to the initial hypotheses: *Delicious* and *Connotea* users tend to have managing their own items on their mind while *Youtube* users are concerned about the findability within the community.

"To keep an archive of useful info for work and hobbies." (*Delicious*)
"I add bookmarks to my delicious in order to keep the all organized. And since they are online, I can keep track of cool websites from anywhere." (*Delicious*)
"To be able to find the item again, not search through 3 pages of Google results hoping to come on the exact link again." (*Connotea*)
"Finding it again, grouping it together with similar papers, organizing/clustering publication space." (*Connotea*)

Table 4: PIM motivations in *Delicious* and *Connotea*

Concerning PIM over time, exactly 50% of *Delicious* users who reported a sharing motive explicitly mentioned that they wanted to store the item for *later* or *future* reference (examples see table 5).

"To keep track of interesting sites that I would want to access in the future."
"To remind myself to read something later."
"It was a page I wanted to revisit in the future."
"Be able to mark it at work and follow upon my home computer."

Table 5: Future PIM in *Delicious*

Perceptions of Tagging

Beside tagging motivations, users were also asked concerning their perception of tagging in general; mean values for perceptions of *ease of tagging* are as follows: In comparison, *Connotea* users perceive tagging as most easy (M = 6.07), followed by *Youtube* (M = 5.36) and *Delicious* users (M = 5.16) while *Flickr* users perceive tagging as most difficult (M = 4.94). However, the differences between the groups are not significant (F (3, 137) = 1.82, p = .146).

Previous studies (e.g. Heckner, Mühlbacher, and Wolff, 2008, Heckner, Neubauer, and Wolff, 2008) have discovered a certain tendency of users to avoid tagging e.g. by entering meaningless placeholder tags or deliberately not assigning any tags. Users of all systems tend not to agree to the statement that they sometimes avoid tags. *Connotea* users are most clearly rejecting this statement (*M* = 1.33), followed by *Delicious* (*M* = 3.00) and *Youtube* (*M* = 3.20) users. *Flickr* users only disagree slightly (*M* = 3.92). Differences between systems are significant (F (3, 137) = 6.769, p = .00). A Tukey test discovers two homogeneous groups with placing *Connotea* in one group and *Flickr*, *Youtube* and *Delicious* in the other.

Tagging is perceived as a useful feature by users of all systems. Most notably, *Connotea* users agree very strongly (*M* = 6.8), while *Youtube* (*M* = 5.52), *Flickr* (*M* = 5.32) and *Delicious* users (*M*= 5.97) express less agreement. Differences are significant (F (3, 137) = 4.232, p = 0.007). A Tukey post-hoc test shows that *Connotea* significantly differs from *Flickr* and *Youtube*.

Tagging is also perceived as a way to classify information objects by users of *Connotea* (5.72) and *Flickr* (5.02). *Youtube* (4.60) and *Delicious* (4.61) users only slightly agree to that statement. No significant difference between groups can be observed (F (3, 137) = 1.542, p = .206).

With Whom do Users Share?

Shneiderman (2002) introduces a model of circles or spheres of increasing social distance which define different types of relationships and related HCI activities. Following this model in our study, users were asked to state whether they shared with *friends or family*, *colleagues or neighbours* or *people personally unknown* to them (*citizens and markets* sphere).
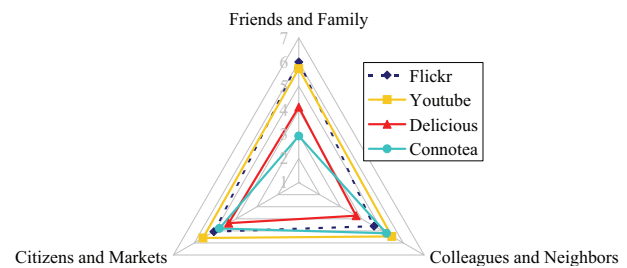

Figure 5: With whom do users share?

For *Youtube* users, sharing was of equally high importance across all three dimensions (cf. figure 5). *Connotea*'s rather professional context is reflected in the low agreement to sharing with friends. However, a motive for sharing seems to be present, which is reflected in relatively high agreement to sharing with colleagues or personally unknown people. *Delicious* scores low on all dimensions which supports the assumption that *Delicious* users are mostly concerned with personal information management.

Perceptions of Search Features in Comparison to Conventional Search Engines

From the quantitative data two groups of systems concerning search evolve: *Flickr* and *Youtube* users perceive tags as helpful for information retrieval, and show a certain tendency towards searching other collections rather than their own collections. *Delicious* and *Connotea* users on the other hand search their own collections more frequently than collections of other users (see figure 6).

Users were also asked about their judgement concerning tags as a means for improved information retrieval performance. Participants responded quite differently for the four systems with *Flickr* users expressing positive attitudes towards search in other than one's own collections. *Youtube* users are more reluctant in relation to performance. Examples of comments concerning search features can be observed in table 6.
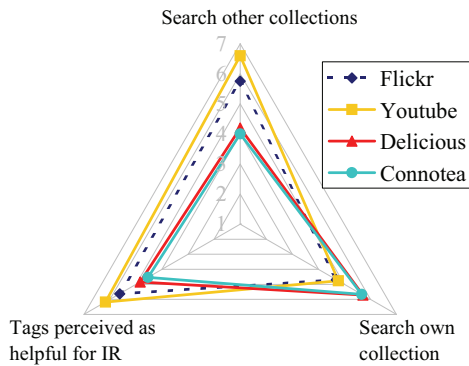
Figure 6: Social Tagging and perceptions of IR

A Model of Information Behaviour in Social Tagging Systems

In the light of this and previous empirical studies of social bookmarking on the one hand and the more general perspective of information behaviour and personal information management research on the other, we want to develop a model of information behaviour in social tagging systems.

In addition, we attempt to classify information behaviour in social bookmarking and tagging systems according to the faceted classification proposed by Cool and Belkin (2002). Like Evans and Chi (2008), we believe that emphasizing the communicative aspects is an important step towards fully understanding social search.

The model is illustrated by figure 7 and is subsequently explained. Before any items can be uploaded to the system, users (user 1 in figure 7) must select items they wish to add. This selection decision is preceded by various kinds of information behaviours, which for purposes of clarity are not included in our model. In the following, information behaviours within the tagging system are described. Table 7 classifies the identified behaviours according to the classification by Cool and Belkin (2002). Since Cool and Belkin lack description details for various classes, we had to establish our own interpretations where needed.

Specific Sharing, Unspecific Sharing, and Personal Information Management

Items are added to the pool by users who upload and annotate (*tag*) new items. These users can have differing and multiple intentions: When a user wants to *unspecifically* share an item he adds or disseminates it to the collection without any further actions. In this sense, sharing can be interpreted as *giving to the community*(citizens and markets sphere). A *specific* sharing action occurs when the item is added and then pointed to by an email, a blog, or any other webpage. Whenever a user sends an email to another user, this communication behaviour can be described as a mediated communication of textual or visual items to one or more users. Emails are sent to specific users who have to evaluate whether they want to follow the links to the items in the collection or not. Also, users can view the blogs and webpages, which use the tagging system as item repository.

"I like to use flickr as a search engine for pictures because you tend to get better quality and more original pictures than you would by just doing a google image search. However, sometimes it's harder to find exactly the image you're looking for, because the search is more specific." (*Flickr*)
"Works much better than anything else for finding good photos." (*Flickr*)
"Flickr's search is very specific - whereas with Google you get more wild cards you don't expect based on information on a page rather than just the tags on a photo. I feel more comfortable using Google's image search for ideas or research since I know that Flickr is all photo - based and that isn't always what I want (sometimes I want drawings, diagrams, etc.)" (*Flickr*)
"Much better. I like Flickr because I can sort by name, date, and other variables, as opposed to Google, that just shows me the most popular." (*Flickr*)
"It seems to be ok, but users seem to tag inappropriately." *Youtube*)
"It annoys me that the titles of the videos are cut off at a certain length. It makes it harder to know if you have the right video or not. Sometimes the tags on a video are misleading." (*Youtube*)
"YouTube search is only good for video, but it's easier to find videos on YouTube and similar sites by simply using video search on Google." (*Youtube*)

Table 6: Example comments of Flickr users' perceptions of search features

When users are guided by motives for personal information management, they store the item for future reference with intentions of organizing or preserving the item for later re-retrieval. The other users of the system do not play a role in the motives of these users.

Retrieve

Items (independent of the intention of the uploading user) can be retrieved and viewed by all web users (indicated by number 2). Browsing can be considered as undirected retrieval, where users serendipitously discover items of potential interest, whereby initially retrieved items are used as step stones or starting points.

Discussion and Conclusion

Results show that sharing and personal information management are both motivations underlying usage of *Flickr*, *Youtube*, *Delicious* and *Connotea*. Analysis of qualitative data supports our initial hypothesis that PIM and sharing are the major sources of motivation for users of social tagging systems.

However, quantitative as well as qualitative results reveal that *Youtube* and *Delicious* users differ in their sharing motives: *Youtube* users want other users to discover their items, while *Delicious* users are mostly interested in finding them again for later reference. This is consistent with our initial hypothesis. Based on quantitative data, no significant
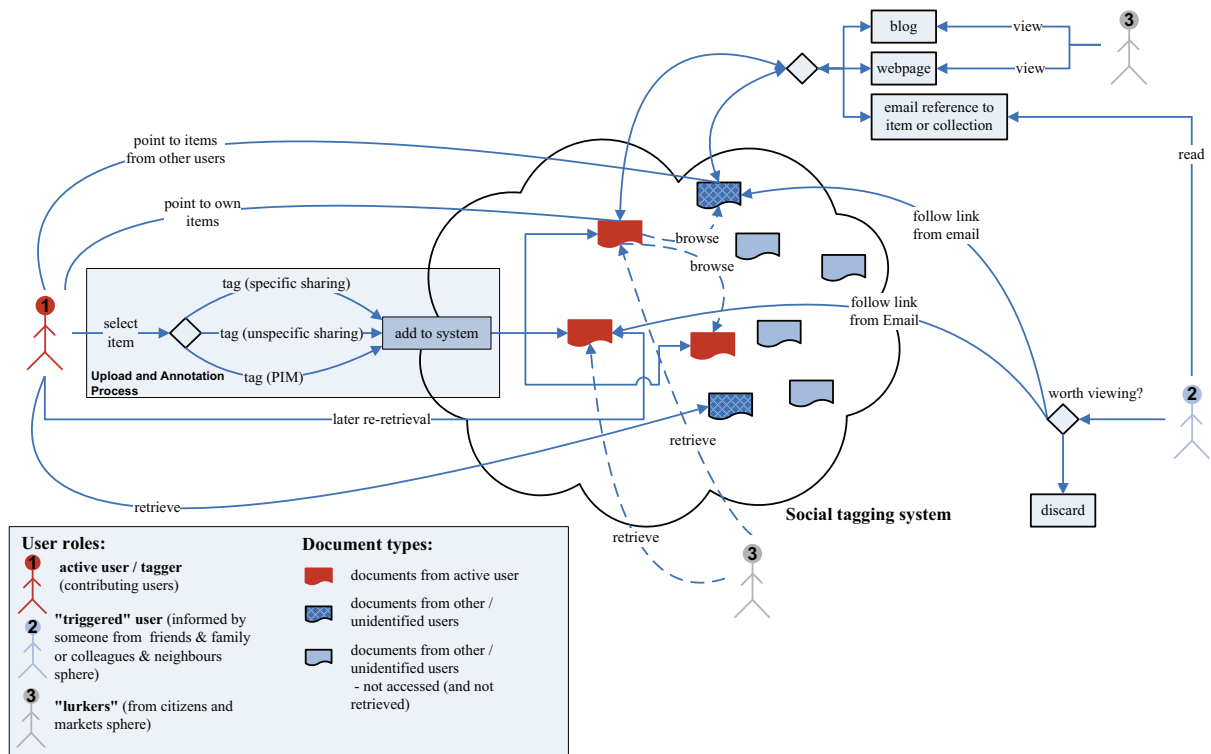
Figure 7: Model of information behaviours in social tagging systems

differences concerning the sharing motive between *Flickr*, *Delicious* and *Connotea* could be discovered. Qualitative however revealed a tendency towards sharing for *Flickr* and *Youtube* users and a tendency towards PIM for *Delicious* and *Connotea* users.

Youtube has a special role when looking at personal information management: *Youtube* users de-emphasize the need for personal information retrieval (also present to a lesser degree) in contrast to users of the three other systems. Nevertheless, even users of systems who claim that personal information management is very important for them, state that sharing is also part of their motivation of using the systems. These sharing roles have been described in detail in Thom-Santelli, Muller, and Millen (2008).

Also, users differ in their perceptions of tagging. The slight tendency of *Flickr* users to avoid tags contributes to data obtained in Heckner, Neubauer, and Wolff (2008), where *Flickr* users were most avidly avoiding tagging (the same tagging systems were compared). Results reveal that tagging is an important feature for *Connotea* users and that users tend not to avoid tags. The fact that *Connotea* users perceive tagging as a useful feature contributes to that view.

The presented results show that sharing and PIM are important motivational sources for users without connecting motivation and tag functions. Future research might be interested in correlations between tag functions and user tasks. Our model emphasizes unspecific sharing, specific sharing and personal information management as underlying motivations of adding an item and stresses possible ways of information interaction between users and the uploaded and annotated items.

As argued by Cool and Belkin (2002), information systems ought to be designed to allow users to follow various information behaviours. The discussion of personal information management, sharing and our proposed model has shown that social tagging systems have already gone far, since many of the classes of information behaviour proposed by Cool and Belkin are represented within these social web applications.

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Information Behaviour in Social Tagging Systems	Classification of Information Behaviour according to (Cool and Belkin 2002)
"select item"	**access**
"tag (specific sharing)"	**create** with intention to disseminate to one or more selected users
"tag (unspecific sharing)"	**create** with intention to disseminate to the whole community
"tag (PIM)"	**create** with intention to organize or preserve
"add to system"	**disseminate**
"point to items from other users"	**disseminate Communication Behaviour:** medium (text, video, image), mode (mediated), mapping (one-to-one or one-to-many)
"point to own items"	**disseminate Communication Behaviour:** medium (text, video, image), mode (mediated), mapping (one-to-one or one-to-many)
"later re-retrieval"	**access** (method: searching, mode:specification)
"retrieve"	**access** (method: searching, mode: (internal / user's) specification)
"worth viewing?"	**evaluate** takes place before accessing
"follow link from email"	**access** (method: searching, mode: (external) specification)
"browse"	**access** (method: scanning, mode: recognition)
"read"	**comprehend**
"view"	**comprehend**

Table 7: Classification of Information Behaviours in Social Tagging Systems

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