

Tagging Personal Information: A Contrast between Attitudes and Behavior

Ofer Bergman

Bar-Ilan University
Ramat Gan, 5290002
Israel
oferbergman@gmail.com

Noa Gradovitch

Bar-Ilan University
Ramat Gan, 5290002 Israel
noa.gradovitch@live.biu.ac.il

Judit Bar-Ilan

Bar-Ilan University
Ramat Gan,
5290002 Israel
barilaj@mail.biu.ac.il

**Ruth Beyth-
Marom**

The Open
University of Israel
Raana 43107 IL
ruthbm@openu.ac.il

ABSTRACT

In a previous work we tested users' preferences with systems that allow to store and retrieve information either using tags or folders. In the current study we asked participants sampled from the same population about their attitudes towards tags by using a questionnaire (N = 168). We then compared the results regarding attitudes gathered in this study with the ones testing actual behavior gathered in our previous one. Overall, results showed positive attitudes towards tagging and multiple classification. These findings are in sharp contrast with our previous behavioral study which showed clear preference for folders and single classification: Our participants tended to agree with statements such as "most people use folders only due to habits", "if users were taught to use tags they would prefer them over folders", and "In 20 years children born today will use mostly"; however in our previous study in which we taught our participants to use tags there was a clear behavioral preference for folders over tags. Most participants in the present study thought that giving several classifications to personal information is a good idea, while our previous results showed that even when tags were used, multiple classification was exceptional. Furthermore, our current participants tended to agree that "the use of tags is more efficient than folder use" while in our previous study retrieval was faster without tags. We conclude this paper with suggestions regarding future research.

Keywords

Personal information management, tags, folders.

INTRODUCTION

Personal Information Management (PIM) is a basic human-computer behavior in which the user stores his/her

information items (e.g. files, e-mails, and Web favorites) in order to retrieve them later. Traditionally, PIM systems provided folders for information storage and retrieval; however, as a consequence of the popularity of Web 2.0, tags also defused into PIM systems.

The main difference between the traditional hierarchal folders method and tags is that in the former users are required to store the information item in a single folder (single classification) while in the later users can apply as many tags as they would like to that item (multiple classification). For example, if a researcher receives an email message from a Ph.D. student regarding their common research project then in the folder method the researcher has to choose one of the various possible classifications such as: 'Supervision', the student's name or the topic of their research. However in the tagging method the researcher can apply all three possible tags to the message. Therefore, upon retrieval the researcher does not need to remember which of the possible folder classifications she had previously chosen, and can use any tag classification that she happens to remember at the time (or their combination) to retrieve the target item. Thus, there appears to be an advantage for tagging and multiple classification over folders and single classification. However users' attitudes towards tags and folders had never been systematically tested, and moreover, it has not been compared to their actual folder/tag preference.

The current research investigated participants' attitudes regarding tagging and multiple classification by using a questionnaire (N = 168). In the Discussion section we compare the findings to those of our previous research (Bergman, Gradovitch, Bar-Ilan, & Beyth-Marom, in press) that tested users' actual folder/tag and single/multiple classification preference when working with systems that allow for both behaviors. As both studies sampled participants of the same population, this comparison can shed light on the similarities and differences between attitudes and behavior regarding tagging.

THEORETICAL BACKGROUND

Single Classification

The hierarchical method (directories and folders) has been used without significant modifications, continuously and almost exclusively, for several decades (Bergman, Beyth-Marom, Nachmias, Gradovitch, & Whittaker, 2008). However, through its long history, it met with criticism for forcing single classification upon the users. Folder hierarchies are designed for single classification; however, in the user's mind, an information item could fit several different categories (Dourish et al., 2000). The user then needs to decide which category fits best, a process that can be cognitively challenging (Dumais & Landauer, 1983; Lansdale, 1988; Malone, 1983). Such categorization also needs to anticipate future usage (Bruce, 2005), which may be difficult because usage changes over time (Kidd, 1994). This causes a retrieval problem, as clearly articulated by Lansdale (1988): "Placing a document into a filing system under one category places the information out of reach if retrieval is required for some other reason" (p. 57). True, folder hierarchies do allow for short-cuts or aliases from one folder to another; however, this seems to go against the simple "put this there" location metaphor (Civan, Jones, Klasnja, & Bruce, 2008) and consequently are rarely implemented by users in practice (Bergman, 2006; Dourish et al., 2000). Criticism of the single classification of the hierarchical method is well established in PIM literature (Bloehdorn & Völkel, 2006; Dourish et al., 2000; Heckner, Heilemann, & Wolff, 2009; Hsieh, Chen, Lin, & Sun, 2008; Lansdale, 1988; Marsden & Cairns, 2003; Quan, Bakshi, Huynh, & Karger, 2003; Warren, 2013).

Tags as an Alternative to Folders

The above criticism motivated a search for a different model. Tags were suggested as a substitute for folders. Tags are a kind of metadata that describe the information item through a keyword or a term. Unlike folders, tags are non-hierarchical and users can assign as many tags as they want to an information item. In recent years, there has been extensive development of tag-related PIM prototypes, including: *Phlat* (Cutrell, Robbins, Dumais, & Sarin, 2006), *TagFS* (Bloehdorn & Völkel, 2006), *Gnows* (Sauermann et al., 2006), *ConTag* (Adrian, Sauermann, & Roth-Berghofer, 2007), *TapGlance* (Robbins, 2008), *Zotero* (Ma & Wiedenbeck, 2009), *TAGtivity* (Oleksik et al., 2009), *BlueMail* (Tang et al., 2008; Whittaker, Matthews, Cerruti, Badenes, & Tang, 2011) and *TagStore* (Voit, Andrews, & Slany, 2012).

The Web 2.0

The Web 2.0 revolution, in which users share their content on the Internet, had a crucial effect on the dissemination of tag usage. Applications such as Flickr and YouTube allow users to upload their pictures and video movies to the Internet together with the relevant tags describing them. Using these tags, the content could then be searched for by other users. In a paper entitled, "Why do tagging systems

work?," Furnas et al. (2006) attributes the success of tagging to the social aspect of Web 2.0:

Tagging systems have become increasingly popular after an element of social interaction was introduced. Social Tagging Systems connect the individual bookmarking activities of users into a network of tags and resources shared among multiple users. Social tagging systems, then, allow users to share their tags for particular resources. The tag sharing allows multiple added benefits, in discovery as well as retrieval... Social tagging systems may thus offer a way to overcome the "Vocabulary Problem" ... showing different users use different terms to describe the same things. (p. 37).

Note however, that these socially-related advantages of tags are irrelevant to PIM (Pak, Pautz, & Iden, 2007) as personal information management is, by definition, solitary rather than social information behavior.

Tags in Current PIM Systems

In recent years, tags defused from content sharing systems to PIM systems, and are currently offered by systems for managing Web Favorites, emails and files:

Web favorites: Del.icio.us is Web-based bookmarking software that uses tags instead of folders. It is both a PIM tool because users can bookmark Web pages for their own personal use, and a Web 2.0 tool because it allows users to share their Web favorites with other users across the Internet.

Emails: Google's Gmail, first introduced in 2004, supplied users with what they termed "labels." At first, Gmail allowed users to use labels only as tags: users could (and still can) add as many tag-labels as they wanted to an email. This method did not move the emails from the single repository where they were contained – the Inbox. Beginning in 2009, Gmail allowed users to use labels also as folders. Participants can drag the email from the Inbox into a label. This is single classification because the email receives only one tag. (It disappears from the Inbox and loses its "Inbox" tag and moreover, if dragged into a second label, it loses its original one). The user needs to "open" the label and go through the messages it "contains" in order to retrieve the information needed. Therefore, Gmail users currently have two ways of using labels: tag-labeling, in which labels are dragged to an email, and folder-labeling, in which emails are dragged into labels. Regardless of the way that they are categorized, there are two ways of retrieving email: by using a location; i.e. opening a label in a folder-navigation-like way or using non-location based search (either by using tags or other search words).

Files: Microsoft introduced tags into its operating system in Windows Vista for several formats, along with the traditional file folders hierarchy and they were retained in Windows 7. Files can be stored either in a single repository

(e.g. My Documents) or in designated subfolders with as many tags as the users choose to assign to the file. The users have three different options for using tags for retrieval: by using search (with one or more tags as keywords), combined with folder navigation (sorting the folder by tags), and using the "arrange by" option (arranging the files by tags instead of by folders).

Comparison between Folder & Tag Efficiency

Several laboratory studies compared between folder and tag usage in PIM. Five studies compared folder use to their own prototypes, testing for storage time, retrieval time, retrieval mistakes and number of mouse clicks: Quan et al. (2003), Ma & Wiedenbeck (2009), Voit et al. (2012), Hsieh et al. (2008) and Sajedi, Afzali, & Zabardast (2012). Three other studies tested in addition to efficiency also for cognitive load and degree of frustration (Civan et al., 2008; Gao, 2011; Pak et al., 2007). Summary of the results of the eight articles is presented in Table 1.

	Folders are better	No Substantial or Significant Difference	Tags are Better
<i>Storage</i>			
Time	Voit et al., 2012; Pak et al., 2007 (exp2)	Sajedi et al., 2012; Ma & Wiedenbeck, 2009	Quan et al., 2003; Pak et al., 2007 (exp1)
Cognitive load	Gao 2011	Pak et al., 2007 (exp1,2)	Civan et al., 2008
Frustration	Pak et al., 2007 (exp1); Gao, 2011		
<i>Retrieval</i>			
Time		Voit et al., 2012; Ma & Wiedenbeck, 2009; Civan et al., 2008; Gao, 2011	Hsieh et al., 2008; Sajedi et al., 2012; Quan et al., 2003
Mistakes	Gao, 2011		Sajedi et al, 2012
Mouse clicks	Hsieh et al., 2008	Gao, 2011	Voit et al., 2012; Ma & Wiedenbeck, 2009; Pak et al., 2007 (exp2)
Cognitive load	Gao, 2011 (secondary task)	Gao, 2011(subjective evaluation)	

Table 1. Summary of papers testing folder vs. tag for efficiency, cognitive load and frustration level.

Table 1 presents mixed results regarding almost all comparisons between folders and tags, giving no clear indication that tag usage is superior to folder usage.

Folder vs. Tag Preference

Two studies had tested user’s folder/tag preference in a natural settings - Rodden & Leggett’s study (2010) and our own previous research (Bergman et al., in press). Rodden & Leggett are two members of the Google research team who were involved in introducing folder-like Gmail labels. This gave them the ability to study the aggregated storage habits of millions of Gmail users around the world. Their findings showed that, with the new possibility of folder-labeling new users’ chances of creating labels doubled and the percentage of folder-label storage exceeded that of tag-label storage. They concluded that “*With this design, the team expects that users will be able to discover and use the more advanced aspects of labeling (such as multiple inclusion) at the point where they identify a need, but it will be important to verify that*” (p. 4595).

Our previous research (Bergman et al., in press) had tested just that, however unlike Rodden & Leggett we made our participants aware of both options so that results could not be explained by users’ unawareness. We conducted two studies in two different environments to increase generalizability: the *Gmail Study* and the *Widows 7* study. In the *Gmail* study we informed 75 participants about both folder-labeling and tag-labeling, observed their storage behavior after a month, and asked them to estimate the proportions of different retrieval options in their behavior. In the *Windows 7* study, we informed 23 participants about tags and asked them to tag all their files for two weeks, followed by a period of 5 weeks of free choice between the two methods. Their storage and retrieval habits were tested prior to the learning session and after 7 weeks, using a designated classification recording software and a retrieval habits questionnaire. A controlled retrieval task and an in-depth interview were conducted. Results of both studies show a strong preference for folders over tags for both storage and retrieval. In the minority of cases where tags were used for storage, participants typically used a single tag per information item. Moreover, even when multiple classification was used for storage, it was only marginally used for retrieval.

The idea for the current research came from interviews we conducted in the *Windows 7* study. We asked our participants for the reasons that they had used or not used multiple classification. Ten of our participants who did not use multiple classification or tagging remained silent and seemed somewhat embarrassed when not responding to this question. A possible interpretation for their reaction is a cognitive dissonance between attitudes and behavior (Festinger, 1957). According to this interpretation these participants may had a positive attitude towards tagging and multiple classification that clashed with their actual

behavior (not tagging), and participants found this contradiction difficult to explain.

The aim of this research is to test computer users' attitudes towards tagging and multiple classification and compare them to their actual behavior tested in our previous research (Bergman et al., in press).

METHOD

We did not want to question the same participants who already participated in our previous study (Bergman et al., in press), as these participants were made highly aware of their folder/tagging and single/multiple classification behavior (we asked them direct questions about it), and we were concerned that they would fit their attitudes to their behavior, as a result of cognitive dissonance (Festinger, 1957) which would bias our findings. Instead we sampled our participants from the same population as we did in our previous research.

Participants

Participants were 168 Israeli information science students. Their age ranged from 21 to 56 ($M = 30.68$, $SD = 7.61$). Forty of the participants were men and 126 women. Participants reported a mid-high level of computer literacy ($M = 3.74$, $SD = 0.98$ on a 1-5 Likert scale).

Questionnaire

The questionnaire started with an explanation of what is PIM, what are tags and in what way are they different from folders. We used multiple choice questions (e.g. where the answer could be preference for tags, no preference or folder preference) and 1-5 Likert scale questions.

RESULTS

Table 2 presents the questions presented to the participants, the percentage of choices of each possible alternative in the multiple choice questions and the result of a binominal test between the two non-neutral answers (excluding the neutral results). The null hypothesis was that participants would select both options equally. In questions 8-11 where we used a 1-5 scale Likert scale we converged the negative responses (highly disagree + disagree) and the positive responses (agree + highly agree) for the binominal test.

Questions	Answers			p
	Good idea	Neither good nor bad	Bad idea	
Q1: Applying several classifications to personal information is a...	77%	17%	6%	.000
	Tags	No preference	Folders	
Q2: Which method is generally better for PIM?	51%	9%	40%	.145
Q3: In 20 years children born today will use mostly	72%	15%	13%	.000
Q4: Which method is better for storing personal information?	35%	16%	49%	.053
Q5: Which method is better for retrieving personal information?	70%	13%	17%	.000
	Multiple tags	No preference	Single tag	p
Q6: When using tags to classify personal information, it is better to use...	70%	6%	24%	.000
Q7: When retrieving personal information with tags, it is better to use...	53%	14%	33%	.005
Q6: When using tags to classify personal information, it is better to use...	70%	6%	24%	.000
	Strongly disagree, Disagree	Neither agree nor disagree	Agree, Strongly agree	
Q8: Most people use folders only due to habits	4%, 8%	27%	44%, 17%	.000
Q9: Tags are not a suitable substitute to folders	21%, 4%	29%	11%, 5%	.000
Q10: If users were taught to use tags, they would prefer them over folders	3%, 15%	35%	37%, 10%	.000
Q11: Tags use is more efficient than folder use	5%, 21%	24%	39%, 11%	.000

Table 2. Results for the multiple choice questions regarding tagging personal information (N = 168).

DISCUSSION

Overall our findings reflect a positive attitude towards tagging that stands in sharp contrast with our behavioral results found in our previous research. This attitude reflects itself in the answers to general questions concerning (a) multiple vs. single classification and (b) the preference for one or the other system and their perceived efficiency; as well as the answers to more specific questions regarding (c) which system is judged as better in storing and retrieving information; and (d) the role of habit in users preferences.

Single Classification vs. Multi-classification

When asked to complete the sentence "Applying several classifications to personal information is a..." 77% of the participants selected "good idea" compared to 6% who chose "bad idea" (Table 2, Q1). Presented with the sentence "When using tags to *classify* personal information it is better to use [multiple/single tags]" (Table 2, Q6), 70% of the participants answered "multiple tags" compared to 24% who answered "single tag". Our previous research indicates otherwise: in our Gmail study when examining only the emails of the 26 participants who used tag-labels (out of the 75 participants of the Gmail study) we found that they had used a single classification for 92% of their classified messages and multiple classification for only 8%.

Completing the statement "When *retrieving* with tags it is better to use [multiple/single tags]" (Table 1, Q7), 54% of the participants answered "multiple tags" compared to 33% choosing "single classification". Again, results of our previous study show an entirely different picture: In the *Gmail* study participants estimated that they had used two tags or more for only 1 message out of a thousand they retrieved, and tended to use the same tag for different retrievals even when *storing* a tag with multiple labels. In the *Windows 7* study participants indicated that they didn't use multiple tags for retrieving files at all.

Tags vs. Folders: Preference and Perceived Efficiency

When asked which method is generally better for PIM (Table 2, Q2), participants were more or less symmetrically divided between both systems. However, when asked about the future, "In 20 Years children born today will use mostly..." 72% replied tags (Table 2, Q3), and tended to disagree with the statement "Tags are not a suitable substitute to folders" (Table 2, Q9). These last results stand in sharp contrast with our previous ones regarding users' actual behavior which showed a clear preference for folders over tags (Bergman et al., in press): in our *Gmail* study tag-labeling was used in only 36% of the classified emails compared to 64% of folder-labeling, however their main reason for choosing tag-labels was keeping the messages in the Inbox rather than multiple classification. In our *Windows 7* study only 6 of 23 participants (23%) tagged any of their files during the 5 weeks free choice activity (two of them tagged only a single file each).

With regard to perceived efficiency, participants tended to agree with the statement "The use of tags is more efficient

than folder use" (Table 2, Q11). However previous studies that tested for efficiency showed overall mixed results with no clear indication for superiority of tags over folders (see Table 1 in the Theoretical Background section). In our own previous research retrievals with tags resulted in more failures to reach the target file and were significantly slower.

Tags vs. Folders: Storing and Retrieval

When asked "Which method is better for *storing* personal information?" (tags or folders) no clear preference was found (Table 2, Q4). However when asked "Which method is better for *retrieving* personal information?" (Table 2, Q5) 70% of the participants answered tags while only 17% answered folders. Contrary to that, our previous results show that folder preference over tags is even more striking for retrieval than storage: In the Gmail study, an average of 16% of retrievals were estimated to be conducted by opening a label compared to only 3% using tag search. And in the Windows 7 study, participants estimated that they used folder navigation for 61% of their retrievals compared to 5% for tag retrieval.

Is Folder Preference a Matter of Habit?

Participants tended to agree with the statements: "Most people use folders only due to habits" (Table 2, Q8) and "If users were taught to use tags they would prefer them over folders" (Table 2, Q10). This was also proposed in (Warren, 2013). However, our previous research indicates otherwise: a clear folder preference was found despite the fact that in both studies we took the time to teach and demonstrate tag use extensively. Moreover, in our *Windows 7* study we deliberately attempted to break the users habits by forcing them to tag their files for two weeks (at that time they had tagged 71% of the files that they had accessed, and used multiple classification on 55% of the tagged files), however this effected only a small minority of participants. Nonetheless, we are aware that in spite of our efforts, habits still work and participants choices may have still be at least partly affected by their past experience. As tags are now implemented more and more, and new users (without previous experience) are exposed to both systems, future studies will be less concerned with the habit effect.

CONCLUSIONS

Overall our findings clearly indicate positive attitudes towards tagging of personal information in general and multiple classification in particular. These positive attitudes are in agreement with a large majority of publications which criticize the single classification of folder hierarchies and advocate multiple classification instead (Bloehdorn & Völkel, 2006; Dourish et al., 2000; Heckner et al., 2009; Hsieh et al., 2008; Lansdale, 1988; Marsden & Cairns, 2003; Quan et al., 2003). Contrary to that, the results of our previous research that tested actual preference (Bergman et al., in press) shows that folders were preferred over tags, and moreover, even when tags were used, multiple classification was exceptional, and even when multiple

classification was used for storage, it was only marginally used for retrieval. Therefore the combination of both studies indicates a sharp contrast between attitudes and behavior for tagging personal information. Tagging and multiple classification seems like a good **idea** to users; however, when they have to **choose** how to store and retrieve personal items they prefer folders and single classification. It seems a good idea probably because users use tags successfully in the Web 2.0 environment, not realizing the differences between PIM and Web 2.0. If so, it is not surprising that participants believe that the implementation of tags in PIM systems is "only" a question of time, learning and overcoming a strong habit.

In (Bergman et al., in press) we suggested several possible explanations for folder preference over tag in PIM including simplicity: It is reasonable to assume that a 1 to 1 relationship (information item *a* is in folder *x*) is easier to remember than a 1 to many relationship (information item *a* can be retrieved by using tags *x*, *y* or *z*). Another interesting question is why do users who use tags in a content-sharing Web 2.0 environment, prefer folders to tags for managing their personal information? We think that the key issue here is familiarity. When looking for content which other users uploaded to the Web, users could not possibly know where it is located. Therefore, searching by tags seems a much better option. In PIM on the other hand, users are very familiar with their own information organization; after all, they stored it there according to their own subjective needs (Bergman, Beyth-Marom, & Nachmias, 2003, 2008). Moreover, they become more familiar with their organization scheme each time they navigate through it to retrieve their files. Therefore, in the great majority of cases, they are able to retrieve their own personal information quickly and efficiently (Bergman, Whittaker, Sanderson, Nachmias, & Ramamoorthy, 2010).

Instead of borrowing ideas from Web 2.0 and applying them to PIM systems, we suggest a different approach - the user-subjective approach to PIM systems design (Bergman et al., 2003). This approach takes advantage of the fact that in PIM, the person who stores the information items is the same person who retrieves it later on. It suggests that PIM systems should use subjective (user specific) attributes given to the information item during the user-information interaction in order to assist future retrieval. The approach has received empirical support, and been used to develop several novel design schemes to improve navigation (Bergman, 2012; Bergman, Beyth-Marom, & Nachmias, 2008). Two such designs have already been positively evaluated (Bergman, Komninos, Liarokapis, & Clarke, 2012; Bergman, Tucker, Beyth-Marom, Cutrell, & Whittaker, 2009). We believe that future research should evaluate a large variety of PIM prototypes for efficiency and actual acceptance.

ACKNOWLEDGEMENT

We thank our participants for their time and efforts. This research was partially funded by the European Union Marie Curie Grant, PERG-GA-2009-248997.

REFERENCES

- Adrian, B., Sauermaun, L., & Roth-Berghofer, T. (2007). *Contag: A semantic tag recommendation system*. Paper presented at the ISemantics' 07 the 3rd International Conference on Semantic Technologies.
- Bergman, O. (2006). *The use of subjective attributes in personal information management systems*. Unpublished Ph.D. dissertation (in Hebrew), Tel Aviv University, Tel Aviv, Israel.
- Bergman, O. (2012). The user-subjective approach to personal information management: from theory to practice. In Z. Marielba & d. O. J. Valente (Eds.), *Human-computer interaction: the agency perspective* (Vol. 396, pp. 55-81). Berlin / Heidelberg: Springer.
- Bergman, O., Beyth-Marom, R., & Nachmias, R. (2003). The user-subjective approach to personal information management systems. *Journal of the American Society for Information Science and Technology*, 54(9), 872-878.
- Bergman, O., Beyth-Marom, R., & Nachmias, R. (2008). The user-subjective approach to personal information management systems design: Evidence and implementations. *Journal of the American Society for Information Science and Technology*, 59(2), 235-246.
- Bergman, O., Beyth-Marom, R., Nachmias, R., Gradovitch, N., & Whittaker, S. (2008). Improved search engines and navigation preference in personal information management. *ACM Transactions on Information Systems*, 26(4), 1-24.
- Bergman, O., Gradovitch, N., Bar-Ilan, J., & Beyth-Marom, R. (in press). Folder vs. tag preference in personal information management. *Journal of the American Society for Information Science and Technology*.
- Bergman, O., Komninos, A., Liarokapis, D., & Clarke, J. (2012). You never call: Demoting unused contacts on mobile phones using DMTR. *Personal and Ubiquitous Computing*, 16(6), 757-766.
- Bergman, O., Tucker, S., Beyth-Marom, R., Cutrell, E., & Whittaker, S. (2009). *It's not that important: Demoting personal information of low subjective importance using GrayArea*. Paper presented at the CHI 2009 Conference on Human Factors and Computing Systems, Boston, USA.
- Bergman, O., Whittaker, S., Sanderson, M., Nachmias, R., & Ramamoorthy, A. (2010). The effect of folder structure on personal file navigation. *Journal of*

- the American Society for Information Science and Technology*, 61(12), 2426–2441.
- Bloehdorn, S., & Völkel, M. (2006). *Tagfs: Tag semantics for hierarchical file systems*. Paper presented at the 6th International Conference on Knowledge Management (I-KNOW 06).
- Bruce, H. (2005). Personal anticipated information need. *Information Research*, 10(3).
- Civan, A., Jones, W., Klasnja, P., & Bruce, H. (2008). *Better to Organize Personal Information by Folders Or by Tags?: The Devil Is in the Details*. Paper presented at the 68th Annual Meeting of the American Society for Information Science and Technology (ASIST 2008), Columbus, OH.
- Cutrell, E., Robbins, D. C., Dumais, S. T., & Sarin, R. (2006). Fast, Flexible Filtering with Phlat: Personal Search and Organization Made Easy. In *CHI 2006 Conference on Human Factors in Computing Systems* (pp. 261-270). Montreal, Canada: ACM Press.
- Dourish, P., Edwards, W. K., LaMarca, A., Lamping, J., Petersen, K., Salisbury, M., et al. (2000). Extending document management systems with user-specific active properties. *ACM Trans. Inf. Syst.*, 18(2), 140-170.
- Dumais, S. T., & Landauer, T. K. (1983). Using examples to describe categories. In *Proceedings of the SIGCHI conference on Human Factors in Computing Systems* (pp. 112-115). Boston, MA: ACM Press.
- Festinger, L. (1957). *A theory of cognitive dissonance* (Vol. 2): Stanford University Press.
- Furnas, G. W., Fake, C., von Ahn, L., Schachter, J., Golder, S., Fox, K., et al. (2006). *Why do tagging systems work?* Paper presented at the CHI '06 extended abstracts on Human factors in computing systems.
- Heckner, M., Heilemann, M., & Wolff, C. (2009). *Personal Information Management vs. Resource Sharing: Towards a Model of Information Behaviour in Social Tagging Systems*. Paper presented at the Third International AAAI Conference on Weblogs and Social Media, ICWSM-09.
- Hsieh, J. L., Chen, C. H., Lin, I. W., & Sun, C. T. (2008). *A Web-based tagging tool for organizing personal documents on PCs*. Paper presented at the International Conference of Computer-Human Interaction 2008.,
- Kidd, A. (1994). The marks are on the knowledge worker In *Proceedings of the SIGCHI conference on Human factors in computing systems: celebrating interdependence* (pp. 186-191). Boston, MA: ACM Press.
- Lansdale, M. W. (1988). The psychology of personal information management. *Applied Ergonomics*, 19(1), 55-66.
- Ma, S., & Wiedenbeck, S. (2009). *File management with hierarchical folders and tags*. Paper presented at the Proceedings of the 27th international conference extended abstracts on Human factors in computing systems.
- Malone, T. W. (1983). How do people organize their desks? Implications for the design of office information systems. *ACM Transactions on Office Information Systems*, 1, 99-112.
- Marsden, G., & Cairns, D. E. (2003). *Improving the usability of the hierarchical file system*. Paper presented at the 2003 annual research conference of the South African Institute of Computer Scientists and Information Technologists on Enablement through Technology.
- Oleksik, G., Wilson, M. L., Tashman, C., Rodrigues, E. M., Kazai, G., Smyth, G., et al. (2009). *Lightweight tagging expands information and activity management practices*. Paper presented at the 27th international conference on Human Factors in Computing Systems.
- Pak, R., Pautz, S., & Iden, R. (2007). Information organization and retrieval: An assessment of taxonomical and tagging systems. *Cognitive Technology*, 12(1), 31-44.
- Quan, D., Bakshi, K., Huynh, D., & Karger, D. R. (2003). User Interfaces for Supporting Multiple Categorization. In M. Rauterberg (Ed.), *Proc. of INTERACT 2003* (pp. 228-235). Amsterdam: IOS Press.
- Robbins, D. C. (2008). *TapGlance: designing a unified smartphone interface for personal information management*. Paper presented at the CHI 2009 Conference on Human Factors and Computing Systems
- Rodden, K., & Leggett, M. (2010). *Best of both worlds: improving gmail labels with the affordances of folders*. Paper presented at the Proceedings of the 28th of the international conference extended abstracts on Human factors in computing systems.
- Sajedi, A., Afzali, S. H., & Zabardast, Z. (2012). *Can you retrieve a file on the computer in your first attempt? Think to a new file manager for multiple categorization of your personal information*. Paper presented at the PIM12 CSCW 2012 Workshop, Seattle, WA, USA.
- Sauer mann, L., Grimnes, G., Kiesel, M., Fluit, C., Maus, H., Heim, D., et al. (2006). Semantic Desktop 2.0: The Gnowsis Experience. In *The Semantic Web - ISWC 2006* (Vol. 4273, pp. 887-900). Berlin / Heidelberg: Springer.
- Tang, J. C., Wilcox, E., Cerruti, J. A., Badenes, H., Nusser, S., & Schoudt, J. (2008). *Tag-it, snag-it, or bag-it: combining tags, threads, and folders in e-mail*. Paper presented at the CHI '08 conference on

Human Factors in Computing Systems, Florence, Italy.

- Voit, K., Andrews, K., & Slany, W. (2012). *Tagging might not be slower than filing in folders*. Paper presented at the Proceedings of the 2012 ACM annual conference extended abstracts on Human Factors in Computing Systems Extended Abstracts.
- Warren, P. (2013). Personal Information Management: The Case for an Evolutionary Approach. *Interacting with Computers, Online first*.
- Whittaker, S., Matthews, T., Cerruti, J., Badenes, H., & Tang, J. (2011). *Am I wasting my time organizing email? A study of email refinding*. Paper presented at the Conference on Human Factors in Computing Systems, Vancouver.