A Comparative Study of Navigation Using Single vs. Community Driven Tag Clouds on Websites

Naureen Nizam
Faculty of Computer Science
Dalhousie University
Halifax, NS, Canada
naureen.nizam@dal.ca

Carolyn Watters
Faculty of Computer Science
Dalhousie University
Halifax, NS, Canada
carolyn.watters@dal.ca

Anatoliy Gruzd
School of Information Management
Dalhousie University
Halifax, NS, Canada
gruzd@dal.ca

ABSTRACT

The purpose of this study is to compare two variations of tag clouds, one where the tags are created by a single author and the other where the tags are created by a community of authors. Using mixed methodologies, data was captured and analyzed for efficiency and enjoyment. The results show that tag clouds, where the tags are created by a single author are more efficient and enjoyable for navigation than those created by a community of authors. The findings from this study also provide recommendations for future research in improving tag based navigation on websites.

Keywords

Tag cloud, website navigation, mixed methodologies, user study.

INTRODUCTION

Today there are estimated to be over 700 million websites on the Web (Netcraft, 2012) with approximately 266 million users in North American alone (Pingdom, 2010). Navigation on the Web can be broken down into two main activities: navigating to the website and navigating to specific content on the website. Search engines such as Google, Yahoo and Bing, help users navigate to websites. Users also find websites by following links from other web pages or directly using URLs. Regardless of the route to a particular website, users need to be able to navigate the site, even if they are just browsing. Even though websites offer different navigation tools to aid users in finding information, such as search, menus, tag clouds, and breadcrumbs, navigation within a website remains one of

the main causes of user frustration on the web.

A set of links on a website are either created dynamically or pre-determined. These links are grouped and placed together usually in a form of a menu. Menus can be problematic to users as information may be located deep in the website and difficult to find. To help users navigate a website, tag clouds are also used. These allow direct access to deep material. Link based features depend on the quality of categorization and the fit between the categories and the user's task and level of understanding. It is important to understand the variations in tag clouds, in particular those where the tags are created by a single author and where the tags are created by a community of authors. In this paper, we examine the efficiency and enjoyment when navigating websites using tag clouds and identify ways to improve navigation on websites that incorporate tag clouds.

BACKGROUND

Tag clouds, are a visual presentation of weighted keywords, labels or tags that link to content on a website (see Figure 1). Tag clouds were first seen in 2004 on Flickr. The tags in a tag cloud are typically presented in alphabetical order, however, different approaches such as random or weight based arrangements have been used (Schrammel, Leitner and Tscheligi, 2009). The weight of each tag is represented by different font sizes and/or colour and typically are based on the frequency of tag. For example, in Figure 1, we see that the tags are presented in alphabetical order and one of the most frequently used tags is the word "wedding". Tag clouds usually co-exist with other navigation tools including menus and search. They are now found on a wide variety of different types of websites including personal and commercial websites, blogs, and social information sharing sites.

The creation of the tags is often a user-generated process, where users manually label items on web pages with related keywords. Depending on the type of the website, tags may get assigned to items by the website owner/author or by a community of authors/users. Tag clouds can also be automatically created by algorithms based on content. Problems associated with tag clouds include: reliable tagging of content, the understanding between the user

assigning the tag and the audience using the tag, and the tag having a number of different meanings to different people.

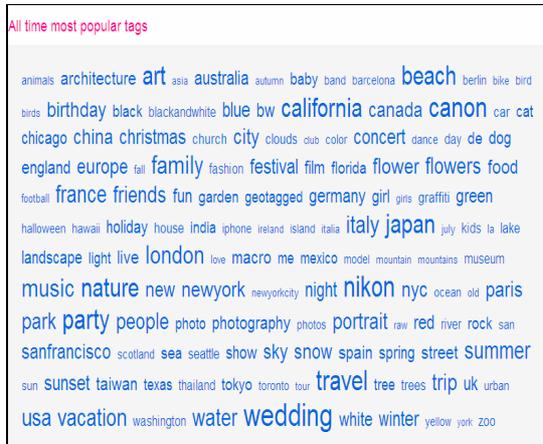**Figure 1. Tag cloud of most popular tags from Flickr**
[http://www.flickr.com/]

Tagging has been studied extensively in the past few years and is considered one of the successful ways to use social tools to find information (Shneiderman, 2011). Improvements for tagging media objects have been explored by recommending tags based on personalized and social context (Rae, Sigurbjornsson and Zwol, 2010). Zubaiga, Korner, and Strohmaier (2011), examined automated classification of content, based on social tagging and user behavior. They demonstrated that segmenting users based on their tagging behavior has a significant impact on the performance of a social tagging system. In addition, a study investigating the extent to which community members consider the whole community while tagging determined that community members tag differently for a community than they do for themselves (Tonkin et. al, 2008).

Social navigation occurs when people navigate by using, directly or indirectly, information from other people. Social tagging (i.e., tags created and assigned by a group of users or community) is important for social navigation. For example, Millen and Feinberg (2008), conducted a study which explored social navigation for a social bookmarking service and concluded that users prefer looking at another person's bookmark collection over browsing a generic bookmark collection. Less research has focused on the generic use of tag clouds.

After the content is tagged, displaying these tags in a form of a tag cloud has been studied and improvements to tag cloud visualizations have been considered. Some of these improvements include displaying semantically similar tags as a cluster, and displaying semantically similar clusters together in a tag cloud, as shown in Figure 2. A larger study was conducted to examine the effectiveness of three navigation tools: tag clouds, menus and search (Nizam, Watters and Gruzd, 2012). The overall results illustrated that users perceive tag clouds as effective as search in finding information. In this paper, we examine the efficiency and enjoyment of tag clouds on websites.

Figure 2. Clustered tag cloud – related cluster per line
[http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.60.9824]

OBJECTIVE AND RESEARCH QUESTIONS

The objective of this paper is to compare specifically differences in efficiency (time and number of clicks to complete given tasks) using two types of tag clouds; one where the tags were created by a single author (SA) and the other where the tags were created by a community of authors (CA). For this study, we concentrated on simple information seeking tasks (i.e., tasks that require judgment in choosing the results but do not require complex decision making, rating of results, or extensive memory).

METHODOLOGY

This study was conducted using mixed methodologies, where both qualitative and quantitative data was collected and analyzed. Qualitative data was captured using questionnaires and interviews, whereas quantitative data (time and number of clicks) was collected using the Morae software.

Participants and Study Design

Fourteen Computer Science students (thirteen males and one female) participated in this study. The study was conducted in a lab environment where participants used Firefox 3.6 to accomplish the tasks.

Participants filled out a background questionnaire consisting of demographic questions and previous experience of using navigation tools on websites, followed by a training session. Participants were then asked to conduct two tasks using tag clouds. The websites along with their tasks were presented in random order. After each task, participants completed a post-task questionnaire and after all the tasks, they completed a post-study questionnaire. The study concluded with an interview session, where participants were asked a series of questions to elaborate on their experience of using tag clouds.

Website and Tasks

The study required four websites, consisting of a tag cloud of either type SA or CA. A focus group was used to select

the four websites and tasks. The websites and tasks are illustrated in Table 1.

Website	Description	Type of Tag Cloud
Professional on the Web	Companies/professionals create their profile and also create tags for their own services. **Task:** *Find two companies that you would consider hiring to redesign a website.*	CA
URL: http://www.professionalontheweb.com/		
Many Eyes	Users create/share visualizations. Users assign tags to their own visualizations. **Task:** *Find two visualizations beneficial for your project on alcohol consumption and its effects.*	CA
URL: www-958.ibm.com/		
Web Designer Wall	A blog of web design ideas, trends and tutorials. Maintained by a single author who tags the blog entries. **Task:** *Find two posts on how to design a website for mobile devices.*	SA
URL: http://webdesignerwall.com/		
Technology Education Know-How	A blog to help teachers use technology. Maintained by a single author who tags the blog entries. **Task:** *Find two posts to assist your friend (4th grade teacher) with resources to supplement his teaching.*	SA
URL: http://www.techedknow.com/		

Table 1: Websites, tasks and the type of tag cloud

RESULTS

Efficiency

Two metrics were used to measure efficiency for the two types of tag clouds (SA and CA): the time to complete the task and the number of clicks to complete the task. Overall participants completed two tasks (one task using SA tag cloud and another using CA tag cloud) in random order, as shown in Table 2.

Tag Cloud Type	Community of Authors (CA)		Single Author (SA)	
	Website 1	Website 2	Website 3	Website 4
Participants	14		14	

Table 2: Data points for each type of tag cloud

Time to Complete

The One-way Analysis of Variance (ANOVA) test was used to determine whether combined tag clouds (CA and SA) were significantly different based on the time to complete the task. The results show that the mean time to complete the task using CA tag cloud (M=4:35, SD=2:45) is only significantly different at the 0.75 level than the SA tag cloud (M=3:00, SD=1:37), $[F(1,26) = 3.435, p=0.075]$. The SA tag clouds were more efficient than CA tag clouds in terms of the time to complete the task. Given the

exploratory nature of this study, a significance at 0.075 level encourages us to further explore the differences between the two types of tag cloud in a larger study.

Number of Clicks

The One-way Analysis of Variance (ANOVA) test was used to determine whether the two types of tag clouds (CA and SA) were significantly different based on the number of clicks. The results show that the mean number of clicks to complete the task using CA tag cloud (M=28, SD=17) is significantly different at the 0.002 level than the mean number of clicks using SA tag cloud (M=12, SD=8), $[F(1,26) =11.605, p=0.002]$. We can conclude that the difference between the mean is statistically significant and that SA tag clouds required fewer clicks than CA tag clouds. CA tag clouds took on average an extra 16 clicks to complete the task (about twice).

Enjoyment

Enjoyment refers to users preferences and their overall experience. One of the goals of the post-task questionnaire was to gather participants experience of accomplishing the tasks using the tag clouds. A 1-to-5 rating Likert scale questions were used to gather this information (1-Very Enjoyable, 2-Enjoyable, 3-Neutral, 4-Frustrating, 5-Very Frustrating). Ratings of 1 and 2 were merged and counted as "Enjoyable" and rating 4 and 5 were merged and counted as "Frustrating". 64% (9/14) found SA tag clouds enjoyable and 14% (2/14) found them frustrating. 43% (6/14) found CA tag clouds enjoyable and 29% (4/14) found them frustrating, as shown in Figure 3. Merging "Neutral" with "Enjoyable" results in similar findings with majority enjoying SA tag clouds (85% compared to 72%). Merging "Neutral" with "Frustrating" results in majority finding CA tag clouds frustrating (58% compared to 35%).
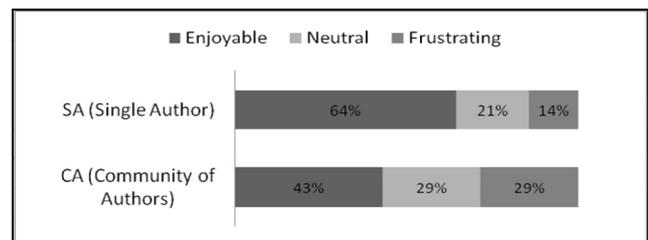

Figure 3. Experience of using each type of tag cloud

The interview session explored each participant's perception of using tag clouds. 36% (5/14) indicated tag clouds were the easiest navigation tool to use, 29% (4/14) preferred using tag clouds and 43% (6/14) considered tag clouds efficient in finding information. In addition, participants indicated that tag clouds are efficient when the appropriate tags (pertaining to their goal) are present in the tag cloud. They also thought that tag clouds are well suited for certain types of websites, such as news and blog websites. They also indicated that tag clouds are not effective on their own and should co-exist with other navigation tools on websites. None of the participants

understood what the tag cloud represented; majority stated that it might be the most searched keyword or the most popular content. Participants disliked similarity between the tags and tags that are too small to read.

SUMMARY OF FINDINGS
The analysis from both qualitative and quantitative data suggests that tags created by a single author, were efficient and enjoyable. Table 3 provides a summary of the findings.

Research Questions	Tag Cloud
Which of the two types of Tag Cloud (SA/CA) is more efficient?	
Time to Complete (ANOVA):	SA Tag Clouds are efficient than CA Tag Clouds at significance level 0.075
Number of Clicks (ANOVA):	SA Tag Clouds required fewer clicks than CA Tag Clouds at significance level 0.002 (statistically significant)
Which of the two types of Tag Cloud (SA/CA) is more enjoyable?	
Enjoyment	SA Tag Clouds were more enjoyable than CA Tag Clouds (64% vs. 43%)

Table 3: Summary of Findings

A very interesting finding was the change in participant perception towards tag clouds from the beginning to the end of the study. From the background questionnaire, we gathered that only 23% (3/14) had used tag clouds prior to the study and majority did not find them effective. After the study, 43% (6/14) indicated that they found tag clouds to be effective.

Although the findings from this study provide sufficient information to generate some conclusions, it is important to note the limitation of this study. The sample was not representative of other users on the web and where small number of participants (a total of 14) was sufficient to perform statistical tests, it is not representative.

RECOMMENDATION AND FUTURE WORK
The findings from this study, indicates that there would be value in conducting a larger study on tag clouds so that improvements to tagging techniques can be explored. The study showed that participants perceived tag clouds to be efficient. One of the findings from the study reflects user frustration when they encountered similar tags in a tag cloud. To decrease the creation of similar tags, selecting a tag from a list of recommended tags during the tagging stage should be considered. In addition, it would be interesting to explore the effects of having the community participate in the selection of the tags. This approach to tagging could be presented in a tag cloud format and the use of appropriate algorithm.

CONCLUSION
Navigation tools within websites should be easily accessible and lead to relevant information quickly. The findings from this study, both qualitative and quantitative,

reveal that users perceive tag clouds to be efficient. Tag clouds where the tags are created by a single author are more efficient (in terms of number of clicks) than tags created by a community of authors. The study provides sufficient evidence to investigate and improve navigation on websites including tag clouds, especially where websites rely on community driven content and tagging.

REFERENCES
Nizam, N., Watters, C., and Gruzd, A. (2012). Website Navigation: An Exploratory Study of Three Navigation Tools for Simple Web Tasks. *Proceedings of the 8th International Conference on Web Information Systems and Technologies*. April 2012. Porto, Portugal.

Millen, D., and Feinberg, J. (2006). Using social tagging to improve social navigation. *Workshop Proceedings of the Adaptive Hypermedia and Adaptive Web-Based Systems AH'06*. June 20, 2006, Dublin, Ireland. Retrieved August 13, 2012 from http://www.sis.pitt.edu/~paws/SNC_BAT06/crc/millen.pdf

Netcraft. August 2012 Web Server Survey. Retrieved August 13, 2012 from http://news.netcraft.com/archives/category/web-server-survey/

Pingdom. Internet 2010 in numbers. Retrieved August 13, 2012 from http://royal.pingdom.com/2011/01/12/internet-2010-in-numbers/

Rae, A., Sigurbjornsson, B., and Zwol, R. (2010). Improving tag recommendation using social networks. *Proceedings of the RIAO'10 Adaptivity, Personalization and Fusion of Heterogeneous Information*. Paris, France.

Schrammel, J., Leitner, M., and Tscheligi, M. (2009). Semantically structured tag clouds: An empirical evaluation of clustered presentation approaches. *Proceedings of the 27th international conference on Human Factors in Computing Systems*, 2037-2040. ACM Press.

Shneiderman, B. (2011). Social discovery in an information abundant world: Designing to create capacity and seek solutions. *Information Services & Use, 31*(1-2), 3-13.

Sinclair, J. and Cardew-Hall, M. (2008). The folksonomy tag cloud: When is it useful?. *Journal of Information Science, 34*(1), 15-29.

Zubaiga, A., Korner, C., and Strohmaier, M. (2011). Tags vs shelves: From social tagging to social classification. *Proceedings of the Hypertext 2011, the 22nd ACM Conference on Hypertext and Hypermedia*, 93–102. June 6-9, 2011, Eindhoven, Netherlands. ACM Press.

Tonkin, E., Corrado, E., Moulaison, H. L., Kipp, M., Resmini, A., Pfeiffer, H. and Zhang, Q. (2008). Collaborative and social tagging networks. *Ariadne,* Issue 54. Retrieved August 13, 2012 from http://www.ariadne.ac.uk/issue54/tonkin-et-al