Contextualizing bookmarks: An approach based on user context to improve organization and retrieval of bookmarks

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ABSTRACT
The ubiquitous nature of the Web has rendered a vast amount of information accessible on demand transforming itself to be the primary hub of personal and collective knowledge. Consequently it is becoming more challenging to manage such information effectively as we face the era of information overload, a.k.a. infobesity. The most popular way of managing web pages is bookmarking. Bookmarks, however, would serve little purpose if they cannot be easily organized or found for re-use. In this paper, we discuss the pros and cons of current folder and tag-based tools and highlight the role user context plays in information retrieval. Then we propose "MemoryLane", a bookmarking tool that offers context-specific tags to help organize and allows navigation of bookmarks by any context users remember.

CCS Concepts
• *Information systems~Social tagging* • *Information systems~Personalization* • *Human-centered computing~Human computer interaction (HCI)*

Keywords
Personal Knowledge Management; Social Bookmarking; Context-based Information Retrieval

1. INTRODUCTION
Internet and the Web have touched and re-shaped almost all facets of our everyday life. Information seeking and acquiring is not an exception to this phenomenon. One of the interesting aspects of Web user behavior is that most users often revisit information found before. The most common way to preserve web pages for later re-use is bookmarking. Bookmarks are typically organized by hierarchical structure (folders) or by tags, also known as "folksonomy". Perplexingly enough, the results of recent studies failed to demonstrate clearly the better performance of tags or folders in bookmark retrieval [3][7]. In this paper, we propose MemoryLane, a tool designed to help alleviate the challenges met by folder and tag-based tools by using user-specific context information as additional retrieval cues.

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2. BACKGROUND
Bookmarks were first offered to be stored in folders, similar to how files are organized in computers. The limitation of such hierarchical structure – that it allows a web page to belong to only one folder – spurred a new trend to emerge: folksonomy, widely known as "tags". As opposed to classical taxonomy of folders, tags allow users to associate multiple personally defined keywords to their web pages. Tagging has become widely popular among users and its implementation can be found in numerous bookmarking tools such as Diigo[1] and Delicious[2]. Some tools have proposed alternative methods for better organization and retrieval of web pages. According to the user experiment by Kawase et al.[6], web annotations helped users to spend the least time in re-finding web pages than bookmarks or search engines. Diigo and Scrible[3] are some of the tools that offer web annotations. The latest trend is the visual bookmarking: examples include Pearltrees[4] and Pininterest[5]. The intrinsic idea seems to be the attempt to enable a different memory channel but we are not aware of any academic study of this approach.

With the advent of mobile and pervasive devices, much attention has been given to incorporating context in information systems. Use of context in bookmarking is still novel. However, a few researchers have conducted experiments with user-context based tools to help users re-find information in recent years with promising results in user experiments. YouPivot, proposed by Hailpern et al. [5] and Refinder by Deng et al. [4] offer users to use context information such as time, location, user's intention or user's activity to re-find target resource. The experiments demonstrated improved performance in retrieval in terms of both effort and time.

3. MOTIVATION
Re-finding the right information can be painstakingly difficulty as the sheer amount of information constantly increases. In a study of 236 experienced web users, the median value of frequency of use of bookmarks as re-access strategy was "sometimes" even though an overwhelming 92.4% of the respondents used bookmarks [1], mostly due to difficulties faced in finding the sought information in the bookmarks. In fact, the classic

[1] www.diigo.com
[2] www.delicious.com
[3] www.scrible.com
[4] www.pearltrees.com
[5] www.pininterest.com

limitation of folders is that users tend to forget where to look when they need a bookmark hidden from the naked eye. This could be caused by the impossibility to associate an information token with more than one folder. Tags may eradicate this problem by allowing multiple keywords to be associated with single resource. Nevertheless tags alone do not effectively solve the problem of re-finding web pages due to the lack of navigability [10] brought on by its parallel structure. This research aims to validate the underlying cause of "forgetting where to look" may not be the limited association between a folder to a web page but the limitation of users' memory. Context has been purported to play a crucial role in recalling memory in human brains [9]. This can be further supported by the positive experiment results obtained by [4][5]. However, these tools have decoupled user context from the content of the web pages possibly diminishing synergic effect of having both semantic and contextual cues to narrow down potential search results. Moreover, the types of context are highly limited and arbitrarily determined without sound empirical grounds. Our research therefore focuses on discerning what are the most useful types of user context in bookmark retrieval and how much improvement can be achieved by using context as additional cue in search and retrieval of bookmarks via a prototypical tool called "MemoryLane".

4. MemoryLane

MemoryLane is a Chrome extension tool that encourages users to provide additional contextual information valuable for search and retrieval. The contextual tags offered in this tool are largely, but not entirely, based on the results of study done by Bischoff et al. [2], which provided interesting insights into what type of tags are in use and how useful each type of tags is for search. The uniqueness of MemoryLane lies in that it attempts to couple tightly both content-related and contextual information to represent each bookmark as a unit of episodic memory[6] which can be traced back via multiple pathways. MemoryLane home page allows users to browse by any fragment of context or content-related tags in visual layout. Table 1 summarizes the types of tags and how each tag is mapped to the unit of episodic memory.

Table 1. Mapping of tag classification by Bischoff et al. [2] to MemoryLane and representation of unit of episodic memory

Bischoff et al. [2]	Episodic memory	MemoryLane
Topic	What	Category (hierarchical classification)
		Concepts, Keywords
	How	Search query used
Time	Times	Date-time, Events
Location	Places	Geo-location
Type	What	(Included in category)
Author / Owner	Who	Contacts (People)
Opinion/Quality	Emotions	Emotion
Usage context	Why (for what)	Goal
Self reference		Reminders, Related files
n/a	Visual impression	Snapshot view of the web page

[6] Episodic memory is the memory of "autographical events (times, places, emotions, who, what, when, where, why knowledge) that can be explicitly stated" [8]

5. CONCLUSION

MemoryLane put forward in this paper considers the importance of user's context in order to ensure easier and faster retrieval of saved web resources. In fact, the human brains store information along with the contextual cues and they are vital for retrieval, which opens a sea of possibilities for this novel approach. By providing user context information as additional tags, we plan to discern the significance and impact of context in bookmark retrieval and which type of user context is most useful for that task, which can bring about substantial changes in personalized information search and retrieval. Furthermore, our proposed tool can also allow users to share their bookmarks with others based on various context information, which will further enrich the experience of "serendipity" exploration.

6. REFERENCES

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