

Trails—An Interactive Web History Visualization and Tagging Tool

Wenhui Yu and Todd Ingalls

School of Art, Media and Engineering,
Arizona State University
Tempe, AZ 85287
{Wenhui.Yu, Todd.Ingalls}@asu.edu

Abstract. In this paper, we described an innovative web history visualization and tagging tool – Trails, which is designed and developed to help people understand their browsing history and habits better. We gathered users' impressions of using Trails, including comparison with traditional web history views, perceived usefulness, privacy concerns, and suggestions to improve the system.

Keywords: Web browsing history, peripheral awareness, information visualization, personal informatics, on-line activities.

1 Introduction

The World Wide Web is said to be the most popular global communication medium and knowledge repository, which is now the platform for a myriad of activities [1]. As more and more human activities have come to rely on the use of the web, people are spending significant amount of time everyday interacting with and through web browser software, to search, work, entertainment and communicate [3]. Thus, our web browsing history is increasingly reflective of our interests, needs and what we do in our daily lives [3]. A class of systems and research about personal informatics has shown that people strive to obtain self-knowledge, collect and reflect on personal information [2]. From this aspect, exploring people's web browsing history is worthy as an interesting direction of study in personal informatics, which is potentially valuable to track our life, understand our habits and foster our awareness [3].

Moreover, people's problematic Internet use problems caused by overwhelming information provided on the Internet also motivate us to explore people's web browsing history and look for solutions. For example, modern office life has shown an increasingly common condition called "attention deficit trait" because of information overload, which might cause productivity losses [4]. A myriad of research work [5][6][7] related has been done around the problematic Internet use behaviors like severe procrastination, Internet addiction and compulsive Internet use, which might result in further problems of stress, depression and sleep disturbances [7][8]. However, people's limited memory determines that they cannot observe some behaviors directly and may not have time to constantly and consistently observe some behaviors [2]. Thus, people are not all capable of discerning what time being spent on

the web is helping us get things done or distracting us from things we want to do. In order to remind people of these problems, tools to help us reflect on our web activities are needed.

Web history storage and retrieval services, provided by most popular browsers, have the potential to serve as a good resource to track our on-line visits. However, the current web history viewers in most popular browsers lack the way to help people reflect on their web activities. This paper mainly introduced an interactive web history visualization and tagging tool, Trails, which was designed and developed to visualize web history data beautifully and informatively in the browser. Through the aid of visual elements, users are expected to retrace their life on Internet and understand their habits better. It is also expected to help users to search and organize the web content faster, easier and more fun.

2 Problems, User Needs and Design Goals

In order to narrow the problem scope and understand user needs, we did user survey among 10 browser-heavy users whose life largely depends on computer and Internet before we developed system. In the survey, other than some questions to understand their self-report browsing habits, we asked them to look into their own web history in a time period and asked them some questions like: “What is your main activity in that time period?”, “Other than the main activity, what other activities you did?”, etc.. And time they spent on figuring out answers was recorded for future comparison with our system. This is very helpful for us to figure out limitations with existing implementations [6]. Take Firefox for example:

- It is not efficient for people to track how frequent they visit a certain URL in a specific time period. The history viewer only shows visits for a whole day in a table, which means users had to locate the time and parse information in that time period by scrolling the table;
- There is a lack of summarization methods to allow people to investigate their own browsing habits. In order to get accurate answers, users have to conclude their behaviors by looking at items in the table one by one;
- There’s no effective way for people to categorize their history visits. Bookmarks are used for storing information of interest, but useless to track the whole browsing trails.

We should address these problems in our work. Moreover, in order to provide better user experience, we tried to ask participants to give feedbacks on solutions provided by some time management softwares (e.g. ManicTime¹) and other web history visualization tools (e.g. Slife²). Then we determined our design goals based on the analysis of results:

- **Intuitive.** Information visualization has been proposed as a way to cope with the problem of “lost” by taking advantage of people’s innate perceptual skills to support cognitive skills [1]. Thus, much like other web history visualization tool,

¹ <http://www.manictime.com/>

² <http://www.slifeweb.com/>

such as Eyebrowse [3], our tool should produce easy-to-read statistical summary visualization for time-management reminder purpose.

- **Unobtrusive.** We brought up this goal when we asked some feedback on Parental Control. Participants indicated that it is an obtrusive way to change people's browsing habits. Based on this consideration, we would like to provide an unobtrusive way to foster awareness instead of annoying people by alarm-like notification or surveillance.
- **Minimal Cognitive Load.** By showing some time-management tools to users, like ManicTime, we realized complicated UI and visuals might be confusing. And majority of participants indicated that they would not like to spend much time on this kind of tool, although they are curious about keeping informed of their on-line activities. Thus, a solution is needed for our tool to help users informed with least mental efforts.

3 Trails

We developed Trails as a Firefox add-on. After installed, one icon will be added at the upper-left corner of UI, which can trigger the Trails application with full features and functions in a new tab view in the browser.

In this section, this paper describes Trails mainly from two aspects: features that make it distinctive, design and implementation details.

3.1 Features

There following are novel features of Trails:

- Peripheral awareness

From the survey, we figured out that people are not willing to spend much time or take efforts on figuring out exact information about their browsing history, while most people are only interested get a general understanding within least time and efforts. Thus, Trails provides users an instantly understandable summary of their activities using several key metrics of visual element (size, shape, color). This strategy utilizes peripheral awareness concept, for the purpose of helping people quickly access, interpret and keep awareness of activities, while at the same time avoiding needless distraction from their main tasks [9].

- Hour-based data retrieval

Trails provides an hour-based view during any given day, so users can easily locate a specific hour or a period of time in a day to understand their activities instead of reading a table. And Trails's timeline was also designed as horizontally aligned "hour blocks" to help users to compare their activeness during a day. This will be elaborated in the design details part.

- Tagging

Tags are not often used in other browsers' built-in web history viewers. Firefox has tagging service, but rarely used according to our survey. Compared to more common service - bookmark, tagging can provide better and more detailed inspections on whole

browsing preferences and life habits. Trails differs from similar efforts by providing an innovative method to organize, tag and display information in intuitive ways, so that people can retrace their web visits based on tags through limited glances.

- **Animated representation and interaction**

Through the aid of visual element and animation effect, users can search and tag the web content faster, easier and more fun. Meanwhile, animations and transitions are very necessary for users to build mental maps of spatial information [10]. This feature is especially useful in filtering content, toggling among views and comparing among different time periods.

3.2 Design and Implementation Details

In this section, the paper will explain the design details of Trails from visual representation and user interaction perspectives, and explain how the design decisions were made from consideration of needs and goals.

Visual Representation. Trails mainly have 4 views: Individual View, Group View, Sort View and Summary View. Every view has its own basic visual element. Different visual elements move, gather together or disperse to build views to facilitate people's understanding.

Visual Elements

Figure 1 (a) describes the basic visual element in Individual View and Sort View, which is the favicon of the visited web page with a tagging ring, representing a URL. The size of the ring is decided by the visit count of the URL in the selected time period. The more visits on an URL, the bigger the ring. The tagging ring can divide into several parts according to the tags the user associates with an URL. Every color represents a corresponding tag. If there's no tags associated, the ring will present with a grey color. For example, in Figure 1(a), there're 4 different tags associated with the URL, which represents 4 different activities assigned on the ring by the user.

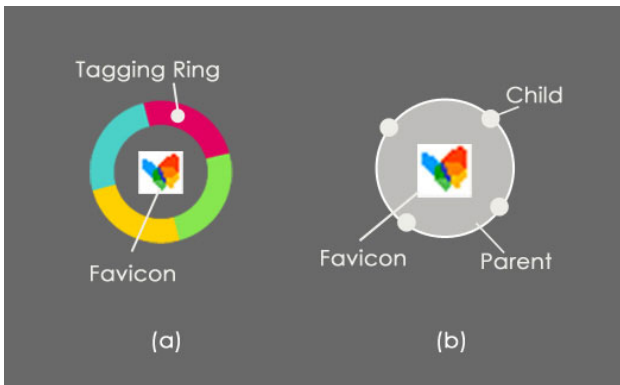


Fig. 1. The visual elements used in different views. (a) is the basic visual element for Individual View and Sort View. (b) is the basic visual element used in Group view.

Figure 1 (b) is the basic visual element used in Group View, which represent a group of URLs with the same domain instead of an individual URL. The favicon of the domain is positioned in the middle (It is possible that URLs within same domain using different favicons). And the size of parent is determined by the total visit count in this group. Children attached on the parent are member URLs in this group, which distribute evenly on the edge of the parent.

Views. There are four views designed, each with different representation emphasis. These four views share same UI controls like search bar, date picker, tags viewer and timeline. Shown in Figure 2, 3, 4, 5, Trails’s timeline is 24 horizontally aligned “hour blocks” with different transparency proportional to the total visits count during that hour. We hope users can understand their activeness of a day just by looking at the timeline.

- Individual View

In the Individual View, Trails loads all the visited URLs in the specific hours and displays them as tagging rings, which spread around the view and move slowly along with time. The connection link between different basic elements shows their “from-to” relationship. Individual View is designed for general understanding of users’ browsing activities. Users can tell the top visits from the size, the attributes of the visits from the colors and the path of visits from connection links with little mental effort.

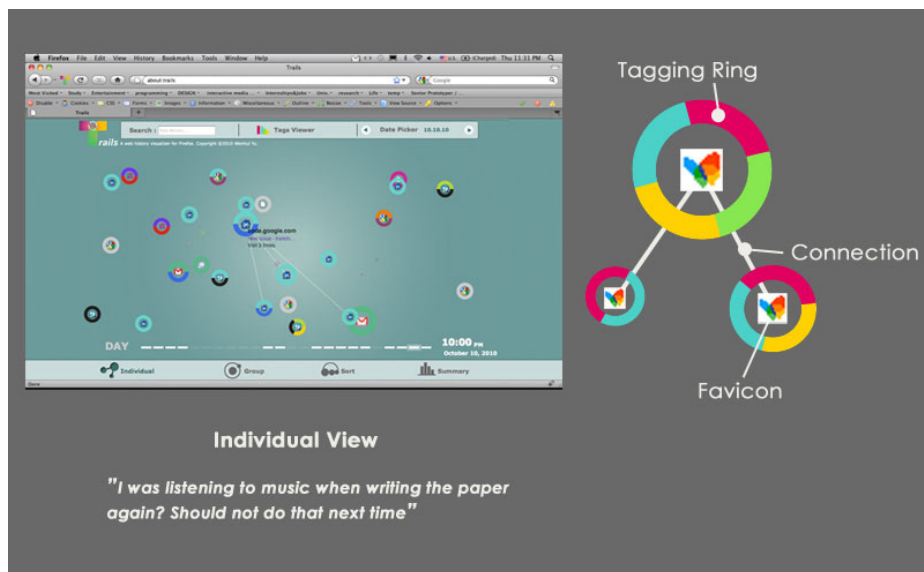


Fig. 2. Individual View

- Group View

Group View is designed for understanding activities in a certain site rather than an individual URL. As mentioned above, URLs within the same domain will be grouped

together as a parent circle with child dots on it (Figure 3 (a)). (a) can be expanded into an orbit-like system by clicking, showing details representation of the group (Figure 3 (b)). And when user click inside the (b), it will collapse back to parent-child look. This solution provides two level of information: by looking at the parent-child visual, users can understand their browsing habits on certain sites in general; by looking at orbit-like visual, users can understand details on their activities in the site.

In Figure 3 (b), the positions of URL tagging rings on the orbits in the same group are decided by the nodes' level in the domain tree [11]. Tagging rings on the same level will be put into the same orbit; the lower the level, the further the orbit from the center. Thus, users can understand their activities and habits in a certain site by looking into the color distribution and shape of orbits instantly, instead of parsing every individual URL. For example, if a user browsed his friend's new album with 20 pictures on Facebook.com. The orbit-like visual will probably show a large orbit with 20 tagging rings distributed evenly on it, which is very easy to cognize because of its distinctive appearance. And if there're tags associated on the tagging rings, that will provide more information to help people understand.



Fig. 3. Group View

- Sort View

In Sort View, URL tagging rings are ranked by visit count, so that users will have good understanding about their browsing habits. When the user trigger the Sort View button, the originally freely moving URL tagging rings will move into a horizontal line from left to right. This view is designed to foster people's awareness of their browsing frequency on certain sites, which is especially for people who have compulsion problem. For example, some people might check their Facebook profile

page or email account every 5 minutes, even when they know there probably won't some useful news for them.

People can also navigate to figure out their visit paths in Sort View, as in the Individual View. However, different from Individual View, connections in Sort View are drawn in arc, instead of line, so that it's easier for people to read and comprehend.

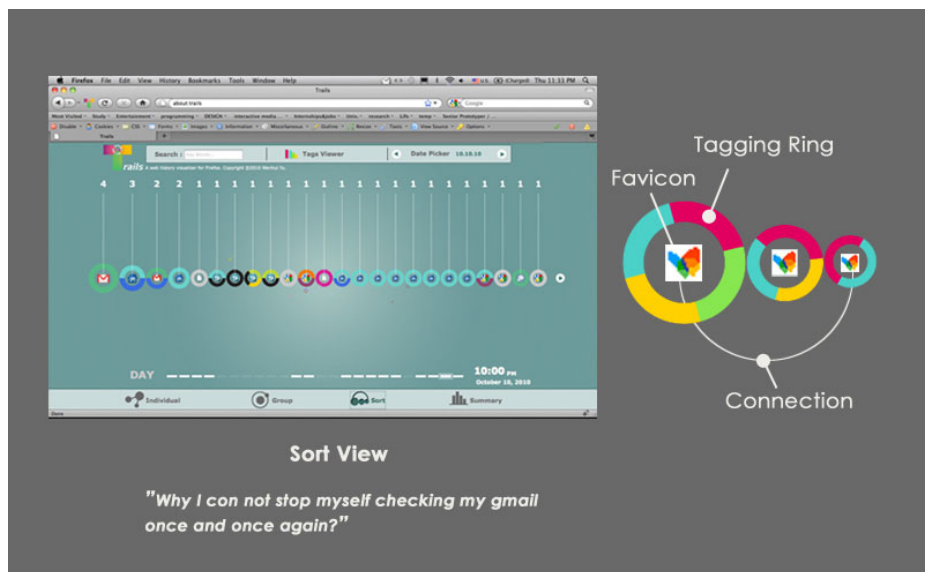


Fig. 4. Sort View

- **Summary View**

Summary View displays visit information based on the tags associated. On the left of view, there's a wheel-like chart showing popularity of tags. In the example of Figure 5, right part of view displays details of all URLs associated with the "lifestyle" tag, with total visits information and visit count for every URL. Summary View is designed for giving users an intuitive understanding of their on-line activities.

User Interaction. Other than visual representation, user interaction is another important aspect of design.

Navigation. Compared to traditional Firefox web history table view, navigation can be a challenge for the current design because of its unordered attribute. Thus, introducing search bar is very necessary to help user navigate in the browsing history. In Individual View (if the current view is not Individual View when search bar activated, the application will jump to Individual View), User can search URLs by typing into the search bar at the top-left of Trails' UI. During User's typing, the URL tagging rings unrelated will disperse and move outside of the view.



Fig. 5. Summary View

Tagging and un-tagging. As one of the most important feature of design, users have several options to tag or un-tag the URL easily and fast.

- Right click on tagging rings can remove the tag instantly;
- Double-clicking on the tagging ring will trigger the tagging panel, where users can attach tags, remove tags or create new tags.

Locate to a specific time period. In order to locate to a specific time period, user should open the date picker on the top right to pick a date. Then users can inspect specific hours' activities by clicking on those hour blocks. When the user is clicking on the block, the URL tagging rings in that hour will move into the view; click again, the URL tagging rings will disperse and move outside of the view.

4 Initial Study

In order to explore usefulness of Trails, initial user study has been conducted among 5 graduate students selected from the preliminary survey. Our study focused on comparing the effectiveness of using Trails to understand users' browsing activities with using traditional Firefox web history viewer, using same period of well-tagged visits, during a limited time, by few glances. The study has two sections:

In the first section, users were asked to understanding the visuals in the 4 views. Users were asked the question same in the preliminary survey, and the time they spent on figuring out answers were recorded. 5/5 participants reported they found Trails is more helpful to help them to understand their browsing habits and activities compared to the traditional table view. 4/5 participants can make successful conclusions by

using first person narratives on browsing habits (see quotes in figure 2, 3, 4, 5). One participant even can tell that “I slept very late” just by looking at hour blocks.

In the second section, users were assigned some tasks to complete. These tasks have: toggling among views, searching a specific content, creating new tag, tagging and un-tagging. Questions related to the participant’s impressions about using Trails were asked. 3/5 participants reported interacting with tagging circles is more fun compared to selecting from tagging list, but not very efficient.

5 Conclusion and Future Work

For the next step, we will install Trails in users browsers and let them try it for two weeks for further in-depth feedback. But based on our initial study, although most participants think Trails is easier to understand their browsing habits and provides a way to organize and categorize their activities, some individuals proposed some concerns on usefulness of Trails, and we also figured out some problems when observing users’ using, which motivate us to go further on exploring better solutions.

For example, we realized the need to tag the URL without navigating views. Several participants complained that they didn’t have time to play with those rings to tag. Thus, we added a small button at the bottom right corner of browser to trigger a small tagging panel for quick tagging a web page without launching Trails. We expect to test the effectiveness of the in the future study.

A participant indicated that it is better to automatically tag some popular URLs or sites instead of asking users to tag everything; another user commented that there should be several ways to group URLs. Thus, we plan to explore the more complicated methods to categorize and group URLs, and correlate these methods with creative visual presentation to facilitate reflection.

Finally, we think Trails is a beneficial attempt, although a lot of future work is needed. For example, all uses showed great interest to explore Trails and were excited about what Trails displayed at the first time, but some people thought they would not use Trails seriously because of lacking motivation to do self-reflection. Thus, we would like to explore better approaches to motivate people to use it. Eyebrowse [3] is a good example by introducing real-time web activity sharing in a social platform, which shows us another way to investigate in the future.

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