Mind your browser

Managing the exploration of information dense spaces effectively using Hierarchical tree structures

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Introduction

Together with the web, the power of personal computers has been growing exponentially. The browser is moving towards the centre of our workflows touching most of the tasks (that get done using a computer). This has resulted in an radical increase in the number of browser tabs that are being opened and kept open at any given time. The problem has been growing over the past decade eversince tabs was introduced as a feature to manage complexity and minimize context switching between windows in web browsers.

Recent studies [1, 2, 3, 4] have shown that most people don't open more than 7±2 tabs, which I believe reflects the cognitive limits of the human mind and the fact that visibility of the tab title - a feature that makes the tab uniquely identifiable - reduces as more tabs are opened. But there are two classes of users who dare to charter into the >10 tabs territory. There are the *bingers* and *addicts* [3] - the habitual tabbers who have more tabs open most of the time and the spiky tabbers who open a large number of tabs but endup closing most of them within a relatively shorter span of time. Through this project, I want to attempt to create a visualization that could aid habitual tabbers like myself in managing the complexity.

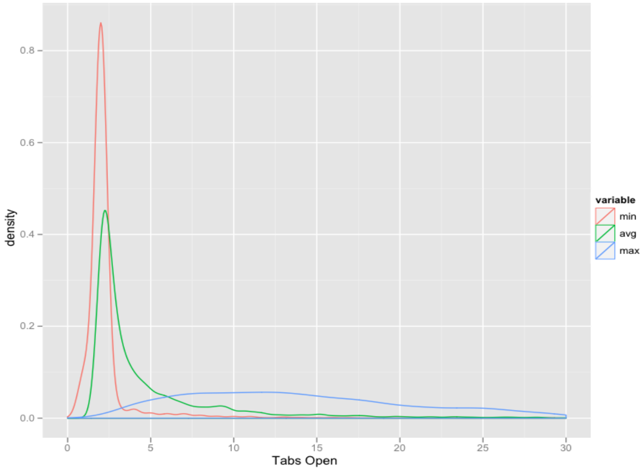


Fig.1 Number of tabs open vs the probability density (1)

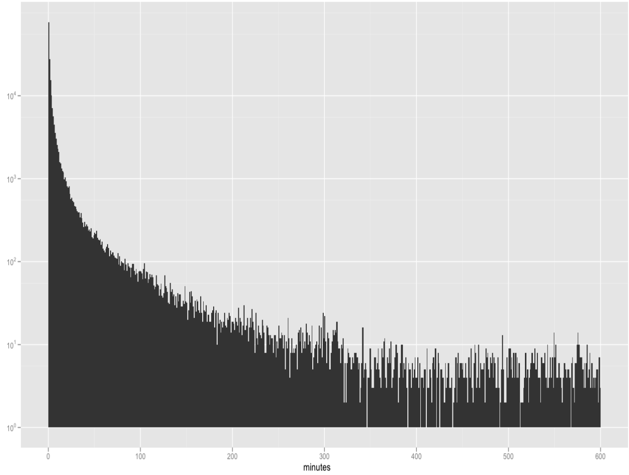


Fig. 2 Number of minutes a tab was open vs the number of tabs that had the life span (1)

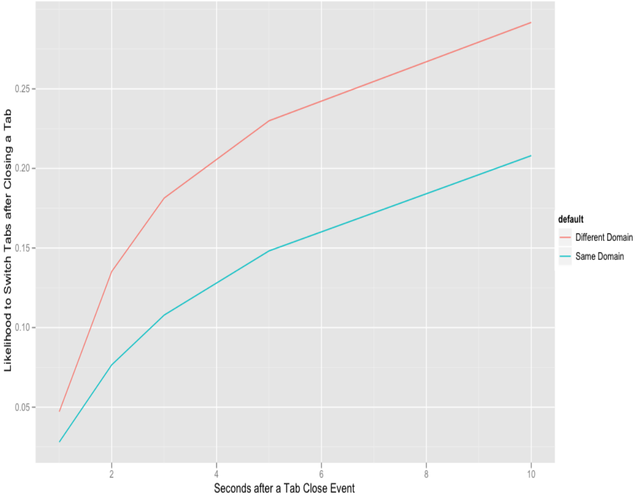


Fig 3. How often the user stays on the tab revealed by the browser after the user closes the current tab that was open (1)

Why I am interested in doing this ?

As a heavy tab user, I tend to discover and open a large amount of tabs while researching a topic. I have invested huge amounts of time in collecting and organizing tabs using bookmarks, but eventually gave up as the solution was sub-optimal. I then started using mind-maps (created with the tool freemind [5]) to help me organize the information space that I was exploring by offloading the information together with the relationships among different elements into a hierarchical tree structure. This approach proved better than managing the information overload using just bookmarks.

I think that the main advantages of using a hierarchical tree structure over nested folders is that the hierarchical tree structure or mind-map (in their form of implementations pertaining to this discussion) :

1. facilitates better overview + context,
2. makes the relationship in the information space more visible,
3. facilitates better navigation through the structure,
4. makes it easier to re-organize information by dragging/dropping a node or a sub-tree structure.

But over time I found that most of the nodes were infact associated with a web-page and it became a hassle to copy URLs from the browser onto the mindmap and switch back and forth to maintain context. For the past couple of years I have been thinking about having mind-maps inside the browser to facilitate managing the complexity of exploring and maintaining context in a large information dense space. The idea faded away as years passed.

Recently we were exploring ways to manage tabs, history and bookmarks in a seamless way to reduce the information overload and conquer the complexity in the context of the course project for another course that I am taking. And the idea of visualizing the information space inside the browser was resurrected.

Proposed Solution

The task of browsing the web for information is inherently hierarchical in structure where in the process of exploring an information space, multiple tabs are opened from a page and the process repeated with the opened tabs until a solution is reached. But if only our mind operated in a perfecly linear fashion and there was infinite time for exploration! Given the time constraints and the nature of our mind to jump from one task to another (and the multi-tasking work culture that demands it), exploring a dense information space such as the web without an aid becomes cumbersome. Partially explored information spaces keep increasing in number and the cost to maintain and switch focus between different contexts keeps increasing. Loss of partially explored spaces (either as a result of user giving up or otherwise) results in loss of productivity.

Keeping track of the information space that we are exploring and navigating it with the help of a visual aid is worth exploring as a possible solution. Using hierarchical tree structures as maps to aid the mind in navigating the information space seems optimal given the nature of the information space. A visualization system that displays tabs in a hierarchical structure is the proposed solution. Users should be able to interactively restructure the tree based on the relationships of their tasks. Users should be able annotate the tree structure that reflects their current understanding of the information space, to reinforce the relationships between structures, and as a navigational and memory aid. This visualization system should result in effectively offloading the overhead of navigating the information dense space from the user.

An example scenario of using the system

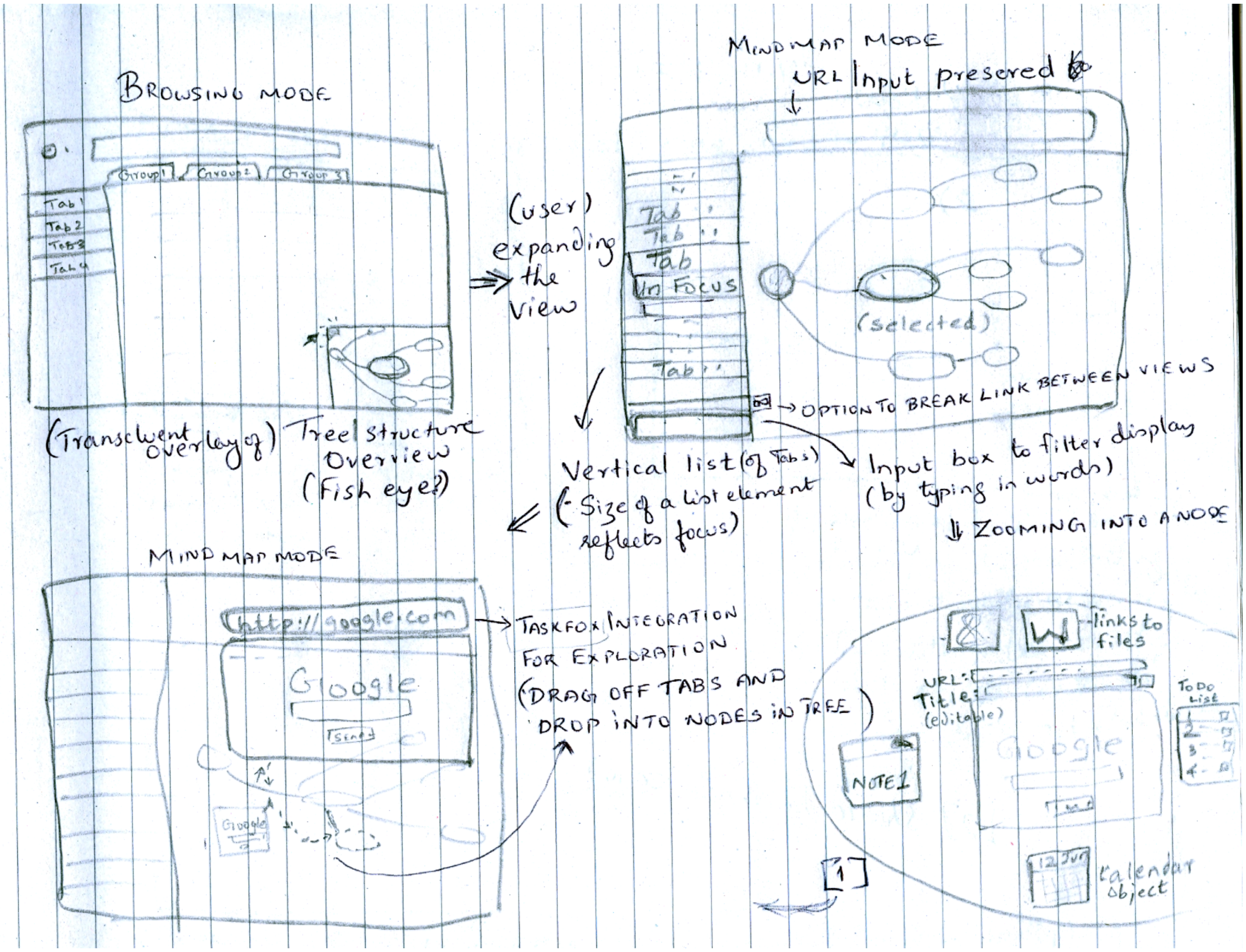
Mr. Zen is an over-zealous person who doesn't have a realistic idea on his time committments (for e.g doesn't know when to stop working on something). He already has around 20 tabs open in his browser. He would have opened more if he wasn't already facing difficulty in navigating through the information space created by the ~20 tabs. He has a huge pile of bookmarks that are collecting cobwebs but still tries to use the bookmarking system when he sees things getting out of hand. Sometimes he goes back to the pages that he has bookmarked and resumes work on them. But a number of times, he looses himself in the current sea of open tabs and the partially explored information spaces tucked deep down in the nested hierarchies of the bookmarks suffer a silent death.

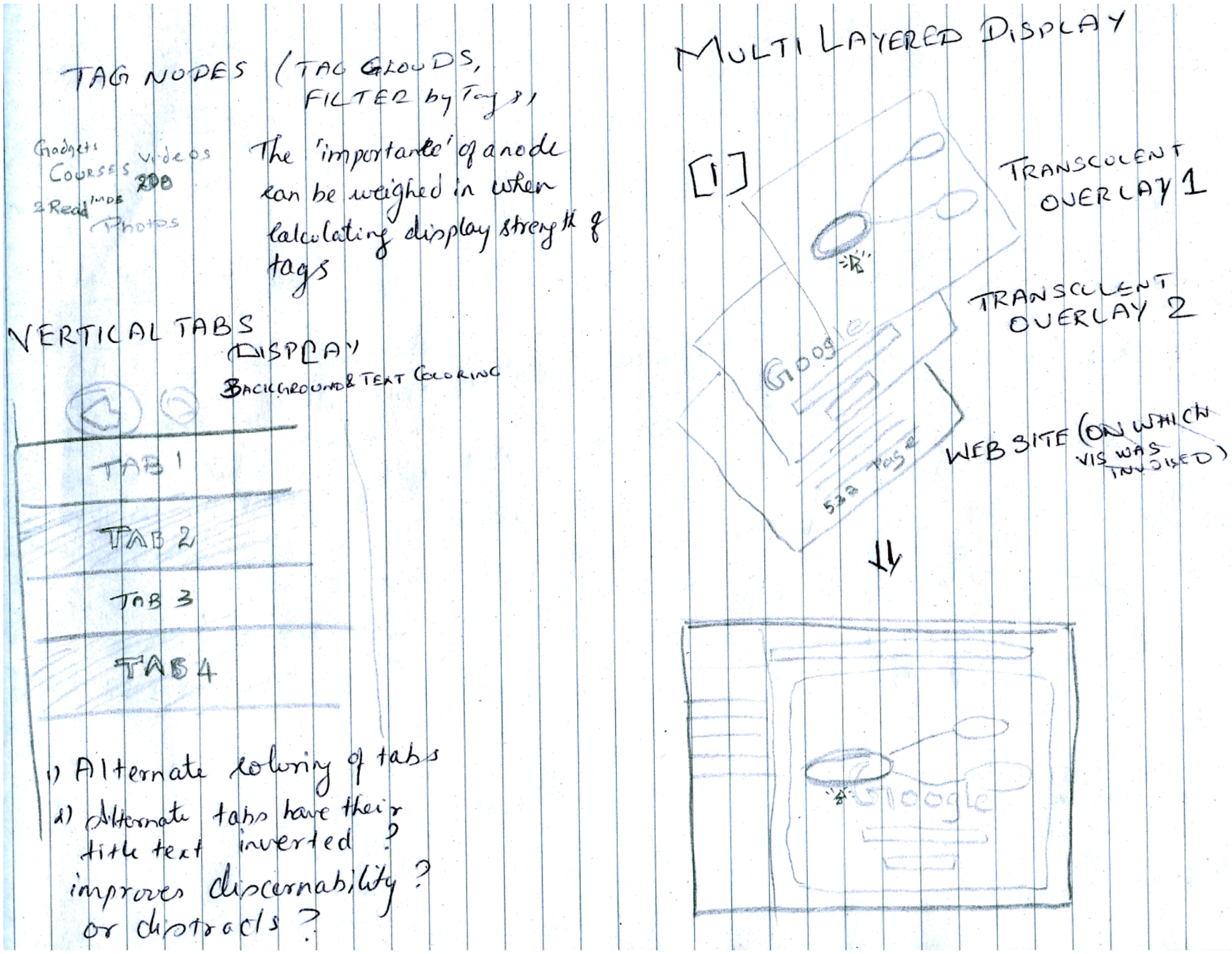
Mr.Zen installs this visualization system as a addon for his browser. He presses the shortcut to invoke the visualization system (configurable to reuse existing tab navigation shortcuts such as Ctrl + Tab or another combination) and is presented with a transcluent overlay (on the current page) displaying the hierarchical tree structure of the tabs. Intially, since this is the first time he is invoking the system, all tabs are presented as nodes belonging to an abstract parent node. He invests some time in rearraging the nodes, renaming the node text, adding annotations (text notes, date objects) to the nodes ...etc, to better reflect the structure in his mind. He observes that the structure makes much sense now. He gets a better overview of where everything is, what needs to be done, what needs more exploration ..etc. He feels a sense of peace returning to him

after a long time. He feels happy.
Mr. Zen observes that he can navigate the tree structure by just using the keyboard. He sees that the nodes have a translucent overlay of the thumbnail image (of the visually distinct top left corner) of the page they are representing and it aids in his navigation. When he selects a node, he observes that the node gets focussed, smoothly zooms in to a small extent, the opacity and size of the thumbnail overlay increases to better reflect the associated page. He also notes that on selection, the information artificats associated with a node (for e.g., annotations) are displayed as small icons laid in path surrounding the boundary of the node. The path containing the artifact icons has a fish-eye effect to it - when he mouses over a particular icon, it expands to reveal more information.

Whenever Mr. Zen wants to switch contexts he invokes the visualization and navigates quickly to the part of the tree corresponding to the desired context, selects the node he is interested in and switches to it. To speed up narrowing down to the desired context, he uses the search bar embedded in the side bar which contains a list of all open tabs and inputs part of the string he remembers about the context. From the narrowed down list of tabs that match his search string, he selects one and switches to that part of the tree. The tabs that he opens from a page are by default grouped under that page from which they were opened. He can restructure them if he wants to.

Exlploratory mock-ups (in decreasing order of sanity)





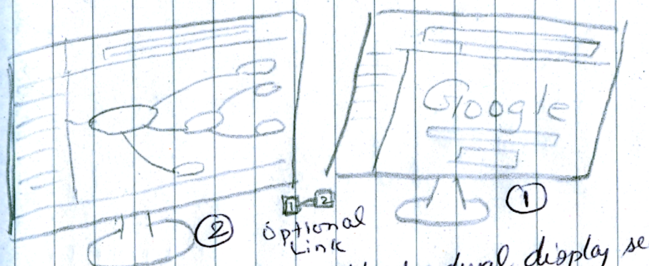
The 'importance' of a node can be weighed in when calculating display strength of tags

1) Alternate coloring of tabs
2) Alternate tabs have their title text inverted ?
improves discernability ?
or distracts ?

Multi-layered display

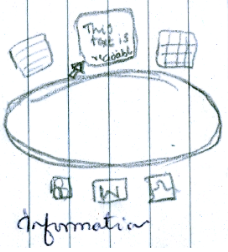
The tree can be displayed as a transcluent overlay on the current page. As user selects the various nodes on the tree, visual cues should be provided as to what the selected node stands for. We can display a cropped up snapshot image of the webpage corresponding to the selected node as another transcluent overlay between the tree visualization and the current page the user is on. The transcluency levels should be such that the user can see approximately on what the node stands for without obscuring or clouding the tree visualization (and the current page is sort of recognizable in the background or we could remove the display of the current page).

DUAL LINKED VIEW



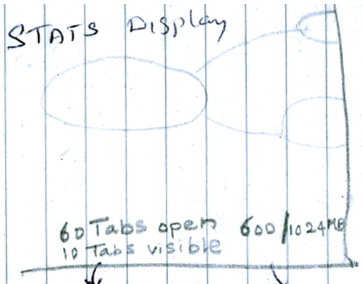
where user can afford a dual display setup, this feature could improve productivity (baseline)

1. by minimising context switches.
2. as the user navigates the web ①, the changes ~~might~~ – seeing that reflected in the tree ②, in action – might result in a more powerful mental model – resulting in a more effective use of the tree vis.



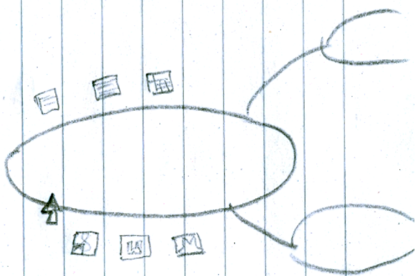
Fisheye effect on icons on mouse over revealing more information

STATS Display



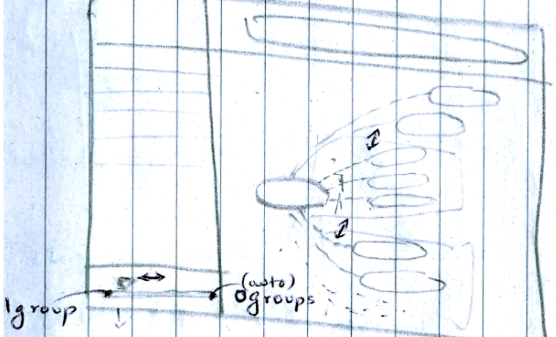
An indication of the number of tabs (in various states)

Memory usage/



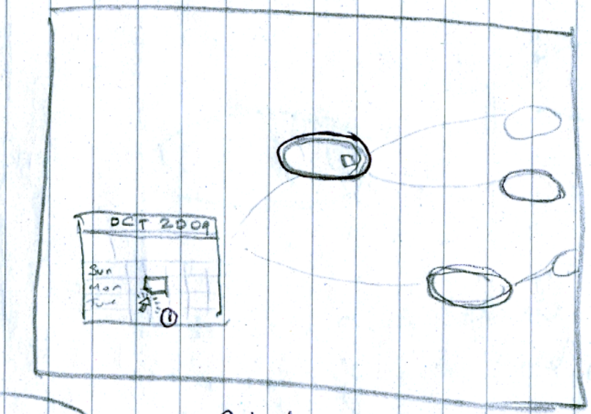
ICONS Appear on mouse over (if the node has associated information artifacts)

GROUP (BY TIME)



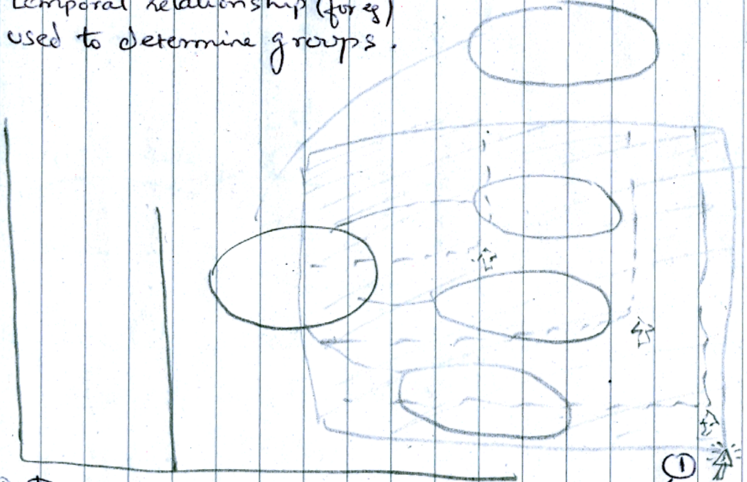
Slider ~~reflecting~~ the threshold on temporal relationship (for eg) used to determine groups.

DATE VIEW



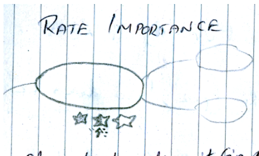
① Selecting a date changes the display by differentiating nodes visually according to the distance between the date object contained within & the selected date

~~multp~~



① DRAGGING A BOUNDARY OVER ~~T~~TABS ASSOCIATES them into a group (groups are[2] easy to differentiate Visually)

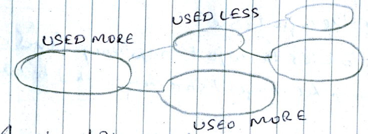
RATE IMPORTANCE



.. Of a node by rating it (in 6 levels)..
3×2

Rating of a node helps to determine ~~the~~ its visual strength (display)

(and also when displaying a tree)
& decision have to be taken w.r.t several nodes



May be differentiate freq of usage visually by size of node.

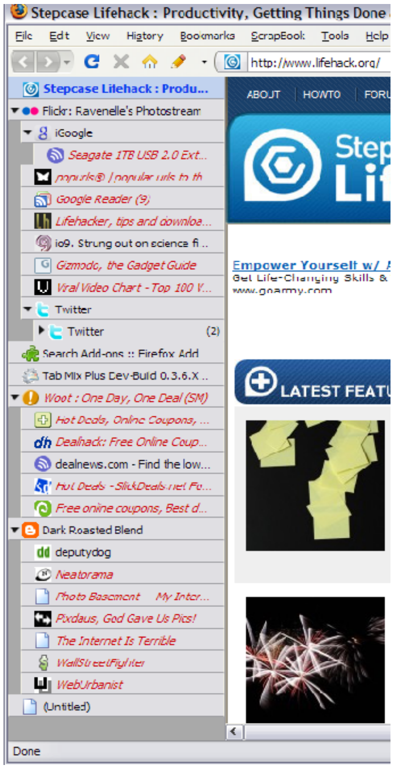
AGE OF A TAB
(ACTVE USAGE)

VISUALLY differentiate tabs that haven't been used for a while &
those that are more actively used

(last used time,
freq of usage)
(~~currently open or not~~)

Possible integrations (if time permits)

There are existing systems [9, 10] that are trying to provide solutions in the same problem space and integrating this visualization system with the existing systems could provide a powerful solution to the user. For example the hierarchical structure of the tree could automatically be reflected in the solution provided by the tree-style tab [9].


Stepcase Lifehack : Productivity, Getting Things Done
File Edit View History Bookmarks ScrapBook Tools Help
http://www.lifehack.org/
Stepcase Lifehack : Produ...
Flickr: Ravenelle's Photostream
iGoogle
Seagate 1TB USB 2.0 Ext...
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Google Reader (9)
Lifehacker, tips and downloa...
io9. Strung out on science fi...
Gizmodo, the Gadget Guide
Viral Video Chart - Top 100 V...
Twitter
Twitter (2)
Search Add-ons :: Firefox Add
Tab Mix Plus Dev-Build 0.3.6.X...
Woot : One Day, One Deal (SM)
Hot Deals, Online Coupons, ...
Dealnews: Free Online Coup...
dealnews.com - Find the low...
Hot Deals - SlickDeals.net Fo...
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Pixdaus, God Gave Us Pics!
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WallStreetFighter
WebUrbanist
(Untitled)
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Get Life-Changing Skills &
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Fig 5. Illustration of Tree-style tabs (9)

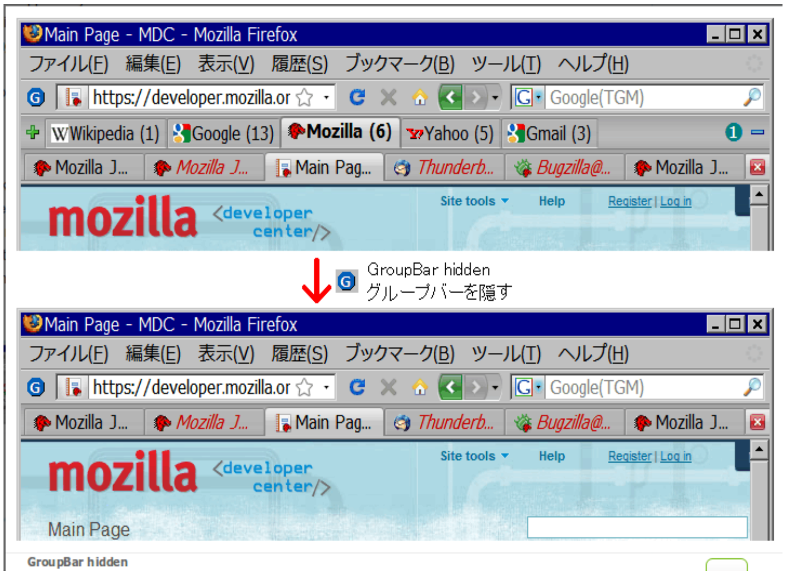

Fig 6. Illustration of TabGroups Manager (10)

Proposed Implementation

I will be using Firefox as the browser platform on top of which the visualization solution will run. The solution will be developed as an add-on for Firefox. I will try to reuse components from Freemind [5] to get the base graph drawing system (with elliptical nodes and smooth cubic B-spline curves connecting the nodes). I will also look into reusing code from similiar visualization solution TabViz [6] that tries to solve the same problem in a different way.

If developing the addon using Javascript turns out to be not an ideal solution given the time constraints of the project and the fact that I am new to the language, I might explore different methods [7] of using a more familiar language to develop the addon.

Milestones

by Nov 6

Must have: explored literature, a basic hello world firefox addon, decided on the language for further development

Good to have: created a simple graph drawing system

Nov 13

Must have: a working hierarchical tree structure that represents the tabs currently open in the browser, ability for user to drag and drop nodes and restructure the tree

Good to have: a translucent overlay displaying the tree structure on the current page

Nov 20

Must have: a visualization that gives good overview of the information space to the user

Good to have: started working on displaying more rich information on the node level on focus, ability to associate information objects (such as notes, dates) to the node

Nov 27

Must have: a basic functionally complete, stable and usable system

Good to have: started integrating the visualization system with similar systems [9, 10, 11] to complement the solution space

Dec 4

Must have: wrapped up core programming work

Good to have: started working on the paper and presentation

Dec 11

Must have: wrapped up all programming tasks, completed core work on paper, presentation

(Good to have: completed all tasks as per schedule !)

Previous work

This seems to the year where people have started noticing the need to do something with the growing information overload inside the browser; for e.g., the Mozilla design challege [8] focussed on developing solutions for 'reinventing tabs'. The solution that is closer to this project is the TabViz [6] that uses radial tab visualization to give a sense of Overview + context to the user.

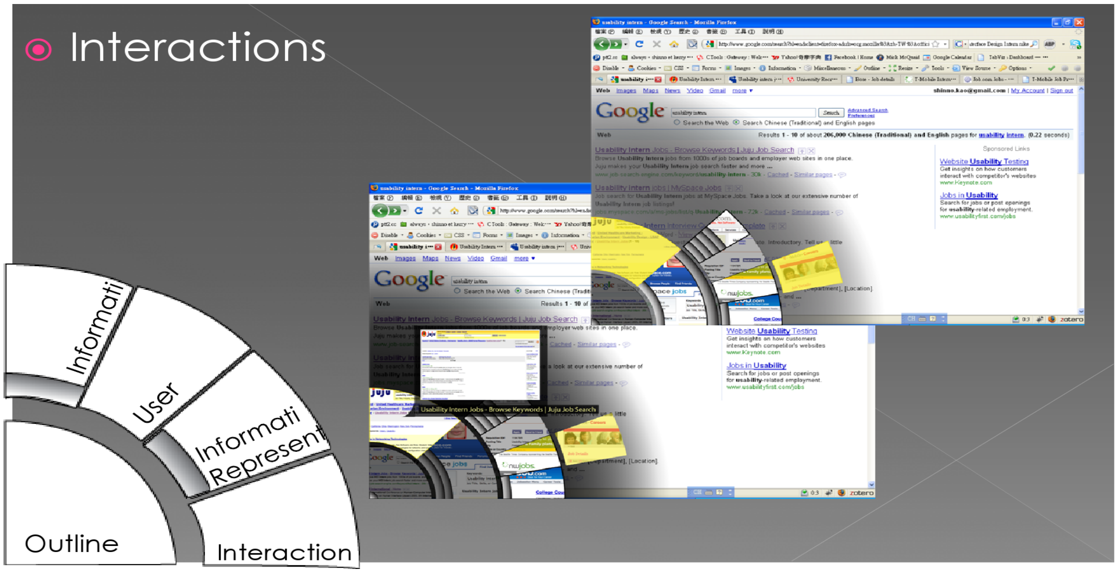

Fig 5. Illustration of Radial tab visualization in TabViz (6)

Conclusion

Several people exploring similar solutions in the problem space in the current time period is an indication of a severe problem that is eating up people's productivity and that needs to be addressed soon enough. Though the solution explored as part of this project might not be ideal for all people, I hope that this project adds value to atleast a subset of the group of people facing the problem and contributes in whatever small way to the solution that ends up being adapted by the majority.

References

[1] Mozilla Labs Test Pilot: Tab Open/Close Study: Results
Based on the data submissions received from approximately 5000 users of Firefox 3.5 during the period between Sep 3 and Sep 24, 2009.
https://testpilot.mozillalabs.com/testcases/tab-open-close/results.html

[2] Alexander Limi (founder of Plone Opensource CMS, developer at Mozilla corporation) 2009,
Reinventing tabs for the browser. The road to Firefox.next: Making tabs better.
http://limi.net/articles/reinventing-tabs-for-the-browser/

[3] Andy 2009, Getting to Know the TestPilot Tab Usage Data
http://surfmind.com/muzings/?p=505

[4] Patrick Dubroy (as part of his Master's thesis at University of Toronto) 2009,
How many tabs do people use? (Now with real data!)
http://dubroy.com/blog/how-many-tabs-do-people-use-now-with-real-data/

[5] FreeMind: A cross-platform open source free mind-mapping software
http://freemind.sourceforge.net/wiki/index.php/Main_Page

[6] Tabviz: Radial Tabs visualization as an extension for Firefox
It was created as part of a graduate student information visualization project at the University of Michigan School of Information by Jakob Hilden, Liz Blankenship and Kerry Kao.
http://code.google.com/p/tabviz/ http://tabviz.org

[7] pyxpcomext: provides Python Mozilla bindings that enables Python to be used inside of Mozilla applications.
http://pyxpcomext.mozdev.org/

[8] The Mozilla Labs Design Challenge 2009: For this Design Challenge we focused on finding creative solutions to the question: "Reinventing Tabs in the Browser - How can we create, navigate and manage multiple web sites within the same browser instance?"
http://design-challenge.mozillalabs.com/summer09/

[9] Tree Style Tab: addon for Firefox that provides tree-style tab bar, like a folder tree of Windows Explorer. New tabs opened from links (or etc.) are automatically attached to the current tab.
https://addons.mozilla.org/en-US/firefox/addon/5890 http://piro.sakura.ne.jp/xul/_treestyletab.html.en

[10] TabGroups Manager: addon for Firefox that enables user to make Groups in the GroupBar displayed above the tab bar, manage several tabs by containing tabs to each Group. Groups can be hibernated.
https://addons.mozilla.org/en-US/firefox/addon/10254 http://axel.my-sv.net/en/

[11] Tabfour: CPSC 544 course project that is exploring methods to manage information overload in the web browser
http://code.google.com/p/tabfour/