

# **Using Social Media Data to Improve Navigation within Websites**

by

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for my Parents

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## ABSTRACT

People often use navigation mechanisms such as menus, search, links and browser tools to find information within websites. The purpose of this research was to explore how user-generated content on social media can be used to help users find information within websites. In particular, we have examined the use of links (i.e., web page URLs) shared on social media sites, such as Twitter, and the use of this information to recommend relevant and popular web pages to the website visitors.

Our preliminary study explored how users use current navigation tools within websites. Our next study focused on the Twitter messages (“tweets”) to identify characteristics of websites that may benefit from the links shared on social media. Using Netlytic, we captured and analyzed tweets about four popular events. The results indicated that 25-47% of tweets across all four events contained a link to web pages. The majority of these web pages were several clicks deep (requiring more than two clicks from the home page). Based on these findings, we developed guidelines and a prototype - a Social Media Panel (SMP). This prototype displayed popular web pages as page thumbnails based on the aggregated information trending on social media sites.

A mixed methodological approach was followed for our final study which included a focus group and a user study. The focus group was used to solicit feedback on the prototype. The prototype was refined based on these findings and evaluated through a user study. The prototype was compared against the current navigation tools and we examined its effectiveness, efficiency and user engagement between the fact finding and browsing tasks.

Through questionnaires and semi-structured interviews, we concluded that participants found SMP to be effective, efficient and engaging for browsing tasks. The analysis of logs and participants’ on-screen activity, revealed that they performed the fact finding tasks faster than the browsing tasks. It was statistically proven that it took fewer clicks to complete the task using SMP. However, the use of SMP did not prove to make a significant difference in expediting the completion of the task.

The combined results from these studies provided a set of guidelines, and recommendations for the SMP. The research helped us develop a website link navigation model and refine the web information classification model for the two types of information seeking tasks: fact finding and browsing. We see the potential of this research to assist website visitors to discover and connect with other social media users who are interested in similar topics and eventually lead these users to topic driven online communities.

## **LIST OF ABBREVIATIONS USED**

<b>CA:</b>	Community of Authors
<b>RQ:</b>	Research Questions
<b>SA:</b>	Single Author
<b>SMP:</b>	Social Media Panel
<b>URL:</b>	Uniform Resource Locator
<b>WWW:</b>	World Wide Web

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## Chapter 1 – Introduction

In 2014, there were estimated to be over a billion sites on the web (Netcraft, 2014). Websites, a collection of web pages, are an important source of information on the web and the number is increasing every day. Due to the continuing growth in the number of websites and the amount of information, finding relevant information has become a challenge; both in terms of finding an appropriate website and finding the appropriate page within that website. Information seekers get to websites in a number of different ways; by typing a website URL on their browser or by following a link from search engine results, social media sites, emails, documents and browser bookmarks. All of these tools are useful in directing users to particular websites, yet the navigation within a website remains one of the main causes of user frustration on the web (Lazar et al., 2003; Bessiere et al., 2004; Lazar et al., 2006; Youwei et al., 2008; Wang et al., 2008; Berg, 2011). When users are unable to complete their task, whether it is fact-finding, information gathering, browsing or transactional (Kellar et al., 2007), there are consequences to the user. These can range from loss of efficiency, user frustration, user dissatisfaction and user disengagement. One of the ways to decrease user frustration is to have consistent navigation mechanisms (menus, search, links, breadcrumbs, etc.) within websites (Stoll, 2012). However, these are largely controlled by the website administrators, who decide which navigation mechanisms to include and exclude from websites.

The broad aim of this research is to improve navigation within a target website, either from the home page or a specific web page within a target website. Links assist users to navigate from one web page to another. Given a target website, these links appear in a form of navigation tools (i.e., menus, search, tag clouds etc.), browser tools (i.e., back, history, browser search, etc.) and are also present on external sites (i.e., search engines, social media sites, etc.) driving traffic into the website. For example, consider a user seeking convocation related information on the Dalhousie University's website. Users may follow the link from search engine results page, social media sites, etc., and arrive at

the “Convocation” page (<http://www.dal.ca/academics/convocation.html>) directly, as shown in Figure 1.1 or they may navigate to the “Convocation” page from Dalhousie University’s home page (<http://www.dal.ca/>). One of the ways to navigate to the “Convocation” page from the home page is to use menus by clicking on the “Academics” link and then the “Convocation” link. It is the navigation from the home page and from specific web pages within a target website (i.e., internal pages) that is being studied in this research.

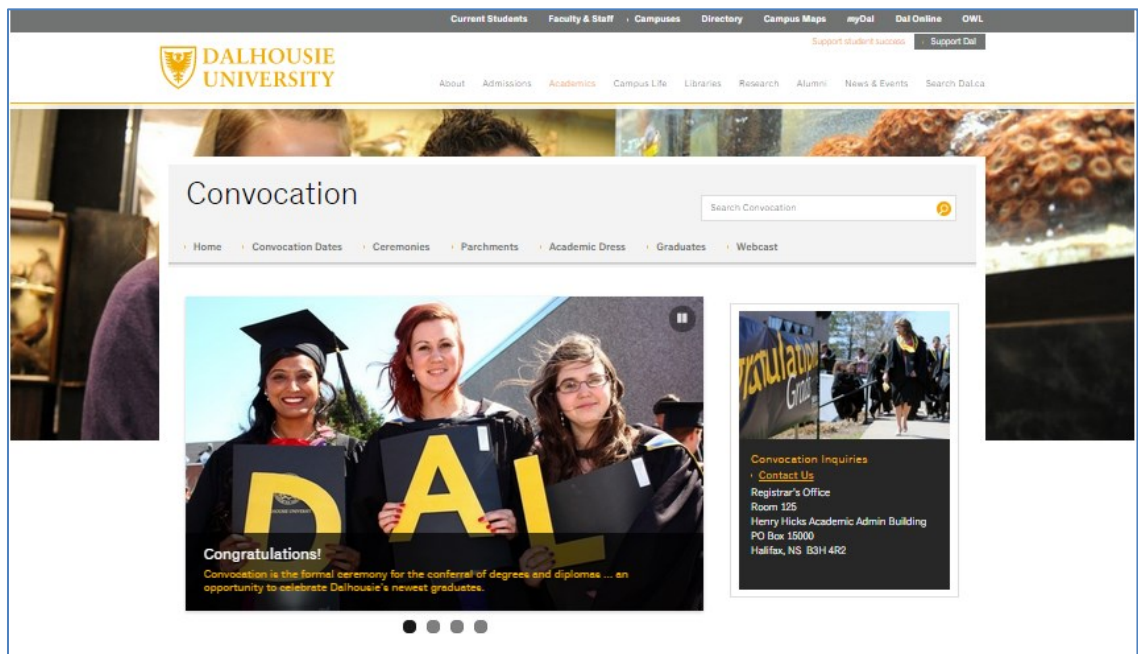


Figure 1.1 - Dalhousie University’s convocation web page

The first phase of this research focuses on navigation to specific pages within a target website using menus, search and tag clouds. The next two phases of this research focuses on navigation to specific pages within a target website using links shared on social media which drives traffic into the website. It is the information shared on social media sites which is examined in Phase 2 of this research as a means of social discovery. Social discovery refers to the search of information where online communities are motivated to find, filter, organize, annotate and summarize voluminous information resources with the goal to create capacity (by aggregating, curating, tagging, commenting, ranking, rating, reviewing and summarizing) and provide solutions (Shneiderman, 2011). Using the social



discovery framework, this research presents how information shared by the community of users can be used to improve navigation within websites.

## 1.1 User-assisted Navigation on the Web

In this research, user-assisted navigation corresponds to data created by users, either explicitly or implicitly, which assist other users navigate within websites. Since Web 2.0, tools have been built to enable a higher level of user engagement including interaction and collaboration among a community of users. One of the early attempts to incorporate user feedback on a website was seen on Flickr ([www.flickr.com](http://www.flickr.com)) in the form of tag clouds, as shown in Figure 1.2. Users tag photos (i.e., assign keywords to photos) and these are presented in a tag cloud format for other users. These tags are links directing users to the tagged photos. This type of user-generated content enables community-driven navigation which creates new access points to the content. Although popular, website navigation with community-defined tags has limitations. Tagging needs users to engage and resources to deal with their input in order for it to be useful (Smith, 2007). Furthermore, tags can become ambiguous to users as more and more people contribute to them and thus less useful as a “within website” navigation mechanism (Smith, 2007, Nizam et al., 2012). Other studies have explored recommender systems, in which the navigation patterns of previous website visitors are utilized to provide recommendations to newcomers (Wang et al., 2008, Flesca et al., 2005), however, the information seeking goals of newcomers may be very different than previous visitors.

Social media sites, such as Twitter, Facebook, Google+ and Pinterest, have become a powerful way for users to create, share and exchange information and ideas allowing the creation and exchange of user-generated content. Integration between social media and websites has been observed and includes: most popular content, activity feeds and recommender feeds.

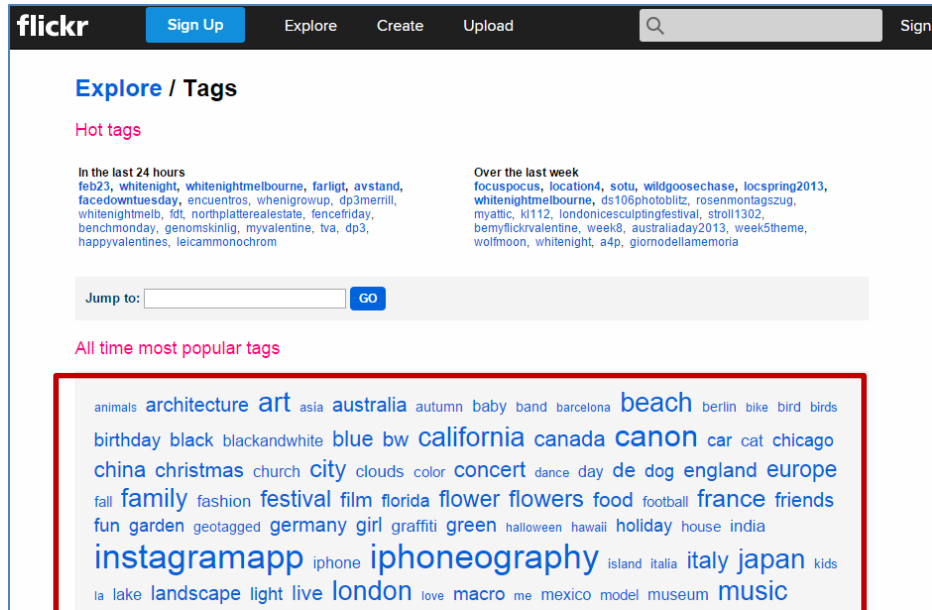


Figure 1.2 - Tag cloud on the Flickr website (<https://www.flickr.com/photos/tags/>)

**Most Popular Content:** Websites, such as Huffington Post (<http://www.huffingtonpost.ca/>), display their most popular or most liked pages, as shown in Figure 1.3. The information is usually based on website statistics or collected from their social media accounts or hashtags in social media.

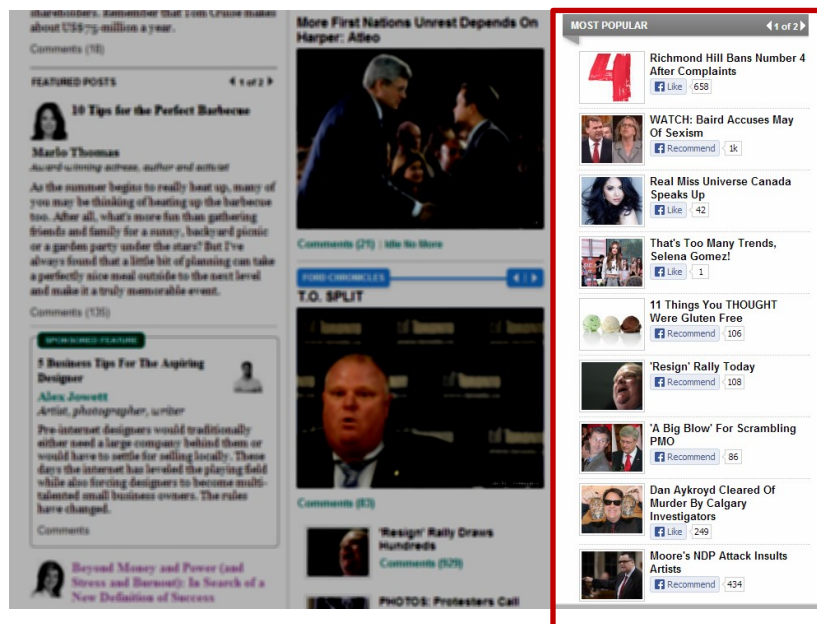


Figure 1.3 - "Most Popular" on Huffington Post website

**Activity Feed:** Websites, such as CBC Sports (<http://www.cbc.ca/sports/hockey/nhl/>), use an activity feed widget (list of messages from newest to oldest) culled from their own social media account (i.e., Twitter). These are used to bring more dynamic content into the website. Similarly, Facebook allows website designers to incorporate an Activity Feed from their Facebook account. Although these widgets include all activities from an account, they seldom point people to specific web pages within a website and can create design challenges as they take up real-estate and can create clutter on a web page, as shown in Figure 1.4.

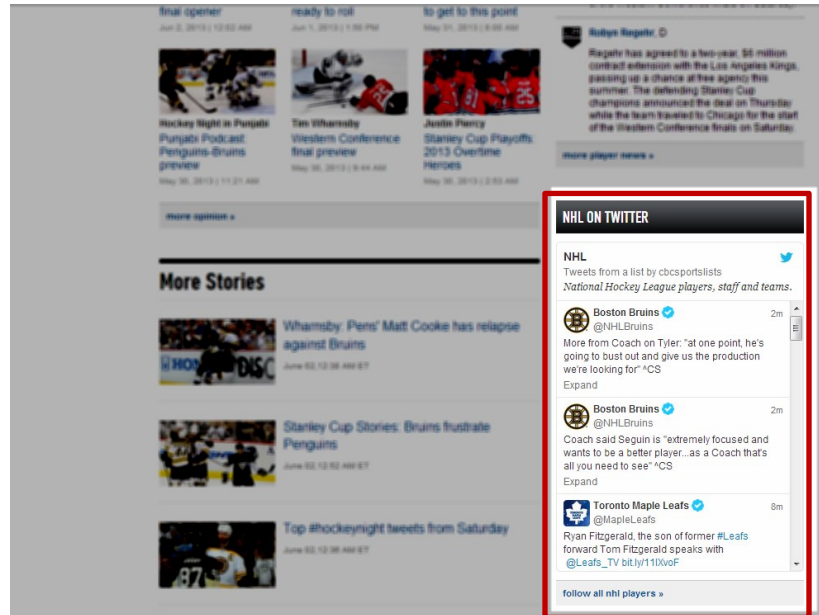


Figure 1.4 - Twitter Feed on CBC Sports website

**Recommender Feed** - A recommender feed displays the most frequently recommended content in a target website. For example, Facebook Recommendations Feed displays the most recommended content on the website, using data from actions, such as Likes, by friends and other people using Facebook. CTV News (<http://www.ctvnews.ca/>) uses such a recommender feed from Facebook in which after a few minutes of the user landing on the website, a pop-up appears on the bottom right side of the web page containing 1-2 links to web pages. The feed shows a picture, a title, and how many people on Facebook have recommended the web page, as shown in Figure 1.5.

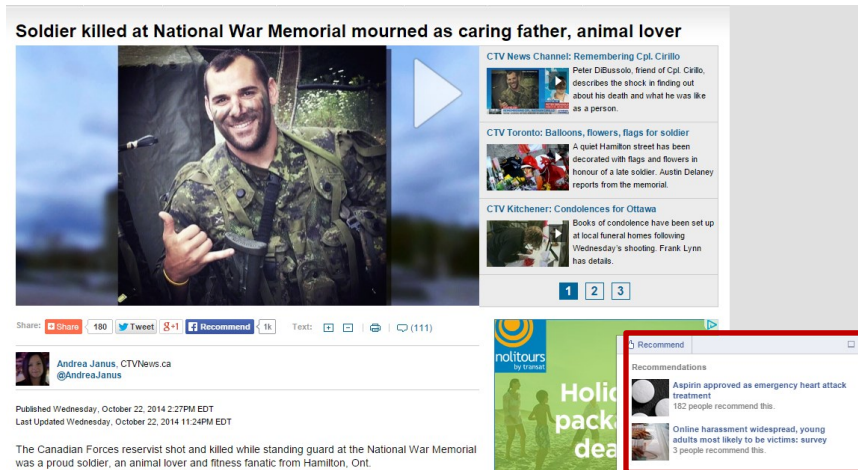


Figure 1.5 - Facebook Recommendations Feed on CTV News website

The above mentioned integration practices are the first steps to exploiting social media for information finding within websites.

## 1.2 Hypertext and Hyperlinks

Hypertext was introduced in 1945 by Vannevar Bush and coined in 1963 by Ted Nelson. Hypertext is text with references (hyperlinks) to other text. The web is composed of many hypertext pages interconnected by hyperlinks, allowing users to go from one web page directly to another. Hyperlinks are referred to in this research as links. Links assist users in navigating within the target website and also to the target website from external sites, such as social media sites. Links created in social media are created in a number of different ways: from users of social media and from the website using social media widgets (e.g. AddThis [www.addthis.com](http://www.addthis.com)), ShareThis ([www.sharethis.com](http://www.sharethis.com)), third party applications, such as Tweetdeck (<https://tweetdeck.twitter.com/>). Figure 1.6 shows how Huffington Post ([www.huffingtonpost.ca](http://www.huffingtonpost.ca)) incorporates social media widgets, allowing users to create and share tweets containing links from within the website.

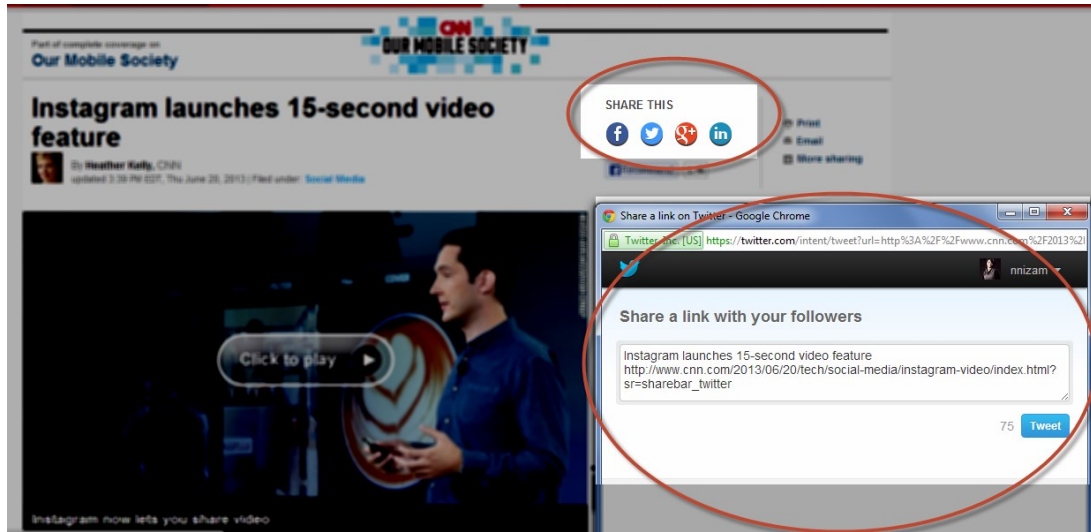


Figure 1.6 - "Share This" Social Media Plug-in on CNN website

This PhD thesis examines links culled from social media (e.g. Twitter), where a community of users have shared links to web pages of a target website, and the subsequent presentation of this information on the target websites, to help users complete their information seeking tasks (fact-finding and/or browsing).

### 1.3 Objective and Research Questions

The overall objective of this research was to explore how social media data can be used to help users find information within a target website. The research was conducted in three phases. Phase 1 was a preliminary study to better understand how users use current navigation tools within websites. The following research questions were explored:

**RQ1:** How do users use website navigation tools (search, menu and tag cloud) for simple information seeking tasks?

- a. Which of three navigation tools (search, menu and tag cloud) are perceived to be more effective, efficient and preferred in finding information for simple information seeking tasks?

- b. Which of the two types of tag cloud (single author-driven vs. community of authors-driven) is more efficient and preferred in finding information for simple information seeking tasks?

Phase 2, informed by Phase 1, was a link analysis study to analyze the pattern of links generated in social media, specifically Twitter, during four events. The following two research questions were explored:

**RQ2: What are the characteristics of links shared on social media pertaining to a target website?**

- a. How often do users share links during these four events on social media?
- b. How many of these are unique links from these four target websites?
- c. What are the top 10 links shared from these four target websites?
- d. What is the depth of links from the website's home page for the four target websites?
- e. What is the type of information contained in those links for the four target websites?

**RQ3: What are the characteristics of links shared on social media pertaining to other websites?**

- a. How many links are to other websites and what type of information is contained in those links?
- b. Which types of websites may benefit from a community-driven navigation tool?

The analysis in Phase 2 led to the development of guidelines for the development of a prototype tool. In Phase 3 we evaluated the prototype using mixed methodology. We conducted a user study to answer the following research question:

**RQ4:** Does the use of links shared on social media, when aggregated and presented on websites, help users navigate websites more *effectively* and more *efficiently* than current navigation tools?

- a. Does the type of web task (fact finding or browsing) affect the *efficiency, effectiveness, or engagement* of navigation based on links shared in social media?

In this study we compared the use of the prototype on two types of web tasks: fact-finding and browsing. Using both qualitative and quantitative techniques, we examined effectiveness (participants' ability to complete the task successfully), efficiency (participants' ability to complete the task in the least amount of time and the least number of clicks) and user engagement (perceived usability, aesthetics, and novelty (O'Brien and Toms, 2008)) to answer our research questions. Table 1.1 describes the three phases, along with the purpose and research questions. At the completion of this research we developed a website link navigation model, produced a set of guidelines and characteristics of websites, and suggested enhancements to the web information classification model (Kellar et al., 2007).

Table 1.1 – Purpose and research questions

Phases/ Studies	Purpose	Research Questions
Phase 1: Preliminary Study	<ul style="list-style-type: none"> <li>To better understand how users use current website navigation tools (search, menus and tag clouds).</li> <li>To better understand the two variations of tag clouds (single author-driven and community of author-driven).</li> </ul>	<p><b>RQ1: How do users use website navigation tools (search, menu and tag cloud) for simple information seeking tasks?</b></p> <ol style="list-style-type: none"> <li>Which of three navigation tools (search, menu and tag cloud) are perceived to be more effective, efficient and preferred in finding information for simple information seeking tasks?</li> <li>Which of the two types of tag cloud (single author-driven vs. community of authors-driven) is more efficient and preferred in finding information for simple information seeking tasks?</li> </ol>
Phase 2: Link Analysis Study	<ul style="list-style-type: none"> <li>To better understand the characteristics of links shared on social media sites (Twitter)                             <ul style="list-style-type: none"> <li>- link traffic to official website and link traffic to external websites.</li> </ul> </li> </ul>	<p><b>RQ2: What are the characteristics of links shared on social media pertaining to a target website?</b></p> <ol style="list-style-type: none"> <li>How often do users share links during these four events on social media?</li> <li>How many of these are unique links from these four target websites?</li> <li>What are the top 10 links shared from these four target websites?</li> <li>What is the depth of links from the website's home page for the four target websites?</li> <li>What is the type of information contained in those links for the four target websites?</li> </ol> <p><b>RQ3: What are the characteristics of links shared on social media pertaining to other websites?</b></p> <ol style="list-style-type: none"> <li>How many links are to other websites and what type of information is contained in those links?</li> <li>Which types of websites may benefit from a community-driven navigation tool?</li> </ol>
Phase 3: Final User Study	<ul style="list-style-type: none"> <li>To evaluate SMP – visual design and concept.</li> <li>To determine whether SMP is efficient, effective and engaging for fact-finding and/or serendipitous tasks.</li> </ul>	<p><b>RQ4: Does the use of links shared on social media, when aggregated and presented on websites, help users navigate websites more effectively and more efficiently than current navigation tools?</b></p> <ol style="list-style-type: none"> <li>Does the type of web task (fact finding or serendipitous) affect the efficiency, effectiveness, or engagement of navigation based on links shared in social media?</li> </ol>



## 1.4 Summary and Structure of Thesis

This research was composed of three major studies, each one building on the previous study. The thesis is structured to reflect this flow.

**Chapter 2** outlines the previous work on website and browser navigation tools as well as an overview of different information seeking tasks, social navigation and social media.

**Chapter 3** provides an overview of mixed methods research and presents our reasoning for selecting the mixed methodologies to answer the research questions. We also provide an overview of the research design and approach.

**Chapter 4** reports on the preliminary study to better understand how users use current navigation tools within websites for simple information seeking tasks. In addition, we examine the two types of tag clouds (single author driven vs. community of author driven) to answer the research questions. We also develop a set of four guidelines based on the results of this study.

**Chapter 5** reports on a link analysis study which deepens our understanding on the characteristics of links shared on Twitter during four popular events. The results from this study are used to develop characteristics of websites which might benefit from information shared on social media sites, in particularly the sharing of link information. We also appended to the set of guidelines and developed a prototype based on the results of this study.

**Chapter 6** reports on a user study including a focus group as a first step. The focus group was used to initially evaluate the prototype and the concept in general. The results from the focus group were used to refine the prototype and provide further insights into the types of websites to use for the user study. We describe the results from both qualitative and quantitative data, including the semi-structured interviews from the user study.

**Chapter 7** summarizes and discusses the main research findings. We respond to our research questions, outline a set of recommendations to improve the prototype, and propose an enhancement to the web information classification model.

**Chapter 8** concludes this thesis with a discussion of the contributions of this research, its limitations and future work.

## Chapter 2 – Literature Review

The objective of this research is to improve navigation within websites with a focus on links: links internal to the target website, keeping users within the website, and links to the target website from external sources (i.e., social media sites). In this chapter, we describe research conducted on website navigation, browser navigation, social navigation and social media, in particularly Twitter. We include background research in improving navigation within websites. The intent is to gain a better understanding of how links are used in information seeking tasks.

### 2.1 Links

Bush (1945) and Nelson (1980) were the pioneers of hypertext, a text with links to other text. In the context of this research, a link is a reference to a web page that the user can directly follow, usually by clicking. Web pages are written in a tagged markup language called the hypertext markup language (HTML) and embed links to other web pages making links an integral part of the web. A user who follows links is said to be navigating the hypertext. A link is expressed as an anchor tag with an href attribute, which names another page using a Uniform Resource Locator (URL) (e.g. `<a href="http://www.dal.ca/">Dalhousie University</a>`). In its simplest form, a URL contains a protocol (http), a server hostname (www.dal.ca), and a file path (/, the “root” of the published file system).

Web pages can be created by anyone which contributes to its explosive growth and is therefore, highly unstructured. Even though this capability provides the flexibility of users to add information on the web, it can significantly increase the difficulty of others in finding relevant information. Search engines, such as Google, Yahoo and Bing, have been useful in assisting users in finding information as they can identify linked documents that best match the search criteria and provide links to the users in a form of a list.

Due to the nature of the web, which can be represented as a hypertext graph with nodes as web pages and edges as links, research has taken place in link analysis. Links add significant amounts of useful information beyond text for search, relevance ranking, classification, and clustering (Cohn and Hofmann, 2001). Researchers have derived ways to improve performance of web search engine algorithms, such as PageRank and Hyperlink Induced Topic Search (HITS) (Page et al., 1999; Deng et al., 2004; Lan et al., 2006). Data mining techniques to mine links have also been studied to detect patterns in security and law enforcement data, bibliographic citations etc. (Getoor, 2003).

The structure and the organization of the website are important to consider in this research due to its interconnection with the website navigation tools. Rosenfeld and Morville (2002) describe the structure and organization of a website as building rooms and navigation design is about adding doors and windows. They also indicated that while a well-designed taxonomy may reduce the chances that users will become lost, complementary navigation tools are often needed to provide context and to allow for greater flexibility. Miller and Remington (2004) examined menus and web search tasks through the use of a computational model of information navigation and found that the optimal structure of the website depends on the quality of the labels (i.e. clear and reliable labels). Numerous studies have investigated the structure of the website with the goal to ease navigation. Lin and Liu (2008) proposed a website structure optimization model for more effective web navigation. They used the average distance of links across web pages to optimize the website link structure. Sreedhar and Chari (2010) looked at various elements of a website to evaluate the quality of website design. They concluded that navigation plays a crucial role in the design of the website structure because it determines the path to be traveled to reach a required web page. In addition, the quality of website structure is based on the average number of clicks per page and structural complexity. The use of links for the purpose of navigating a web page has been studied primarily to detect revisitation patterns and improve web browser navigation mechanisms, such as "*History*" which allows users to return quickly to a previously visited page (Tauscher and Greenberg, 1997).

## 2.2 Website Navigation

The ability to navigate from one page to another within websites is referred to as website navigation in this research. This research focuses on links as a primary mechanism for navigating websites in order to complete web tasks. These links can be part of the target website and keep users within the target website (i.e., internal links), they can be associated with the web browser, and they can even exist in other websites driving traffic to the target website (i.e., external links). Figure 2.1 illustrates a website link navigation model composed of the target website, the website navigation tools, the browser navigation tools and social media.

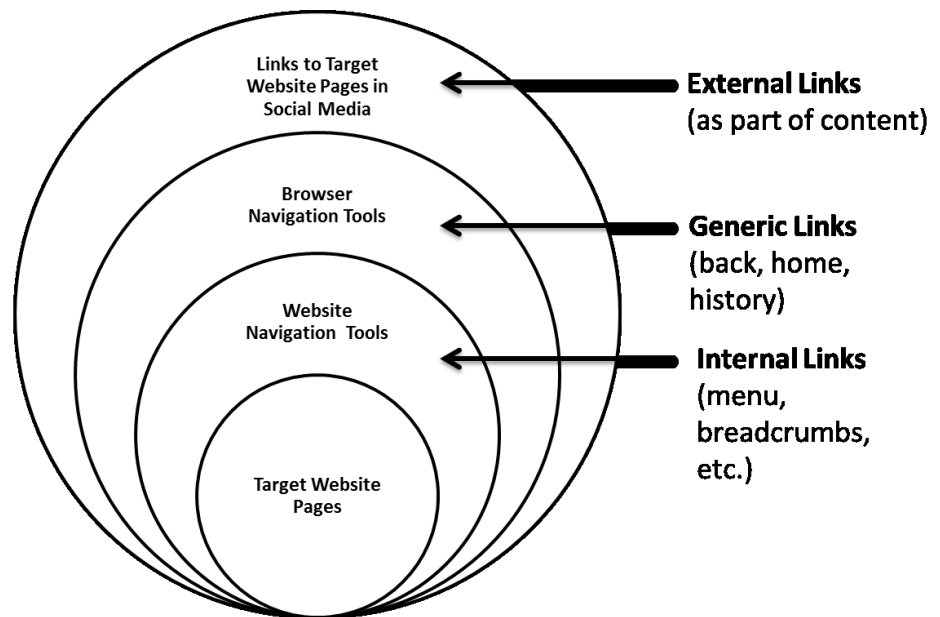


Figure 2.1 – Website link navigation model

### 2.2.1 Internal Links

We refer to internal links as those that point users to specific web pages within the target website. To assist users in finding information, websites include several navigation tools, such as menus, search, breadcrumbs and tag clouds, as shown in Figure 2.2 and 2.3. Menus are part of most websites and are typically used as a primary navigation mechanism. In a menu, the categories are presented in a list format (either horizontally or

vertically) and these are links to other pages within the website. A search text box can be found on websites with a high volume of web pages and allow users to enter keyword(s) in the text box. Results are then retrieved based on those keyword(s). A tag cloud, also known as weighted list, is a visual presentation of keywords, labels or tags to illustrate content on a website. The tags are typically shown according to their frequency and appear in alphabetical order. In addition, these tags are links which when clicked, redirects to specific pages on the website. Tags are either generated or assigned by a single author or community of authors. The collaborative nature and translation of tags to annotate and categorize content, also known as collaborative tagging, social classification, social indexing, and social tagging, help classify information and is commonly referred to as folksonomy or taxonomy. Due to their popularity, they can be found on a wide variety of websites including personal and commercial web pages, blogs, and social information sharing sites.

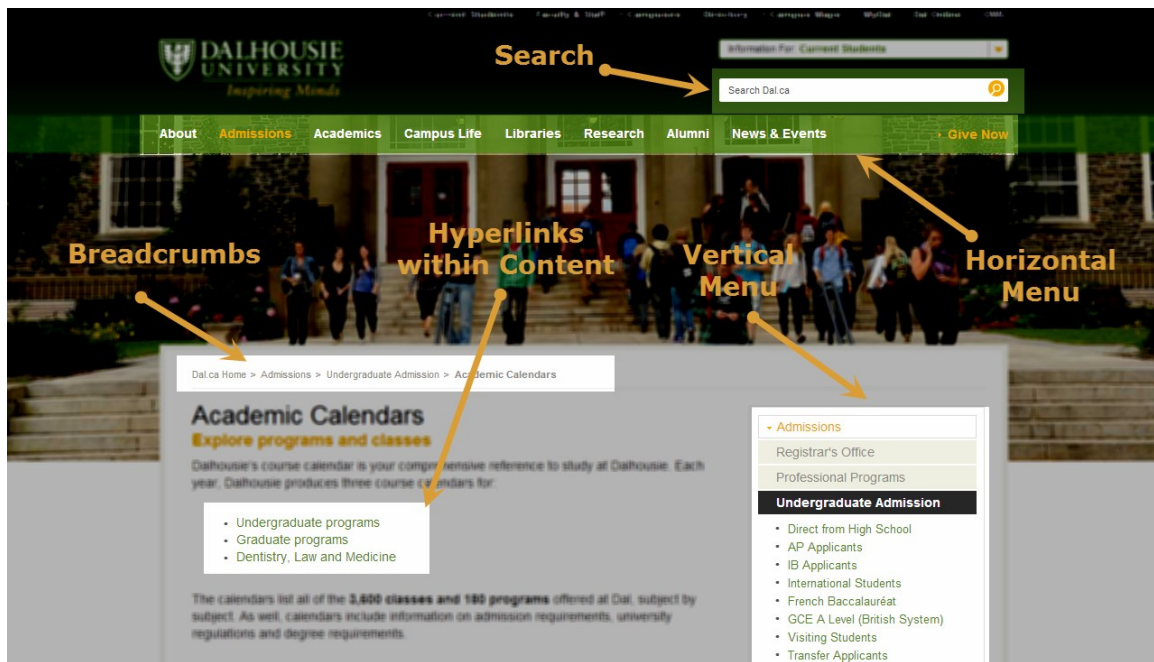


Figure 2.2 – Website navigation mechanism on Dalhousie University’s website

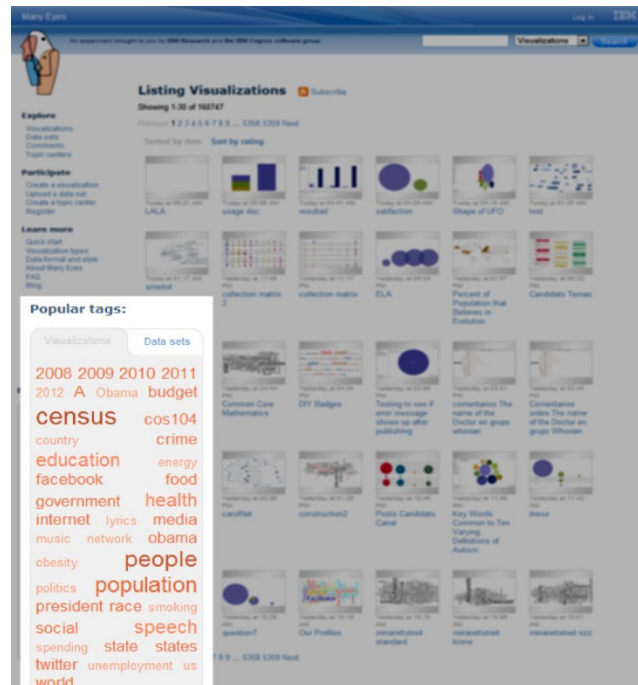


Figure 2.3 – Tag cloud on the Many Eyes website

These navigation tools have been studied individually and collectively. Tullis et al. (2005) conducted an online study to evaluate six variations of menus on a website and concluded that drop-down menus were the most effective to navigate websites. Sinclair and Cardew-Hall (2008) explored whether tag clouds are useful as an aid to find information on websites. They conducted a user study where participants had an option to either use a tag cloud or search text box and found that when the web task was more general, participants preferred the tag cloud. They also concluded that tag cloud is not sufficient as the sole means of navigation for a folksonomy-based dataset. Hearst and Rosner (2008) examined tag clouds using qualitative methods and found that tag clouds are primarily used because users perceive them as having an inherently social or personal component because they suggest what others are doing or interested in and also because they change over time. They also concluded that tag clouds are perceived as fun, popular and/or hip yet people object to tag clouds because of their visual aesthetics, their questionable usability, and a perceived bias towards popular ideas and the downgrading of alternative views.

Tag clouds and those that are community driven highlights the concept of “social navigation” and its main objective is to help people make decisions by using, directly or indirectly, information from other people. A number of studies have looked into understanding social navigation and the importance of social tagging on websites. Millen and Feinberg (2006) examined popular social bookmarking services (dogear) to see how it supports social navigation. They concluded that social tags used in the context of a social bookmarking service are an important way to improve social navigation and that users preferred looking at another user’s entire bookmark collection than browsing tag collections, hence, supporting the importance of social tagging to improve social navigation. Tonkin et al. (2008) investigated the extent community members consider community while tagging. They determined that community members tag differently for a community than they do for themselves. Zubaiga et al. (2011) demonstrated that segmenting users based on their tagging behavior has significant impact on the performance of automated classification of tagged data for a social tagging system.

Birukou et al. (2006) explored the phenomena that people tend to behave like other people have behaved previously, even in situations like selecting a link on the web. Realizing that social navigation aims at providing assistance in such situations, they proposed an approach of implicit culture in which people are encouraged to behave according to the “usual” behavior of the community. Similarly, Wang et al. (2008) proposed a graph-based recommender system, in which the navigation patterns of previous website visitors are utilized to provide recommendation for newcomers. Rae et al. (2010) addressed the task of recommending additional tags to partially annotate media objects (images) using information from four contexts (all photos in the system, user’s own photos, photos of user’s social contacts and the photos posted in the groups of which a user is a member). They evaluated their approach against Flickr and showed that using personalized contexts can significantly improve tag recommendation. Shneiderman (2011) referred to tagging as one of the common practices benefiting individuals in finding information while helping the community to be aware of the information.



Once the content is tagged, however, the layout of these tags is crucial. Improvements to tag cloud visualizations have been studied and several approaches to presenting tag clouds have been developed. Hassan-Montero and Herrero-Solana (2006) presented an approach to use clustering algorithms for visually displaying tag clouds, with the aim of improving browsing experience. Kaser and Lemire (2007) presented models and algorithms to improve the layout of tags clouds. Schrammel et al. (2009) conducted a series of experiments designed to evaluate the effects of semantic versus alphabetical and random arrangements of tags in tag clouds. The results of their work indicated that semantically clustered tag clouds can provide improvements over random layouts in specific search tasks and that they tend to increase the attention towards tags in small fonts compared to other layouts. In addition, they found that semantically structured tag clouds were preferred by users for general search tasks. Lohmann et al. (2009) examined tag cloud perception and performance with respect to different user goals. Through a comparative study of several tag cloud layouts, they were able to show differences in task performance, leading to the conclusion that interface designers should carefully select the appropriate tag cloud layout according to the expected user goals. They also used eye tracking to provide additional insight into the visual exploration strategies of tag cloud users.

The above studies examined navigation within websites based on either links created in the website by a single user (menus, search) or a community of users (tag clouds). There are other ways for users to navigate within websites, such as the web browser, which is described in the next section.

### **2.2.2 Browser Navigation Tools**

When considering navigation within a website, it is important to consider the navigation mechanisms offered by the web browser to assist users to get from one web page to another. The navigation mechanisms offered by a typical web browser includes the “back” button, “forward” button, “search”, etc. as shown in Figure 2.4. Earlier research by Milic-Frayling et al. (2004) reported that 43% of all web navigation activity was a

result of links and that the back button accounted for 23% of all navigation. Other navigation tools such as bookmarks, typed in URLs, “home” button, “refresh” button, and the “forward” button accounted for 0-3% of all navigation. Researchers in the area of web browser navigation, consistently report a high use of the “back” button and this has resulted in improvements in the “back” button (Kellar et al., 2007). The browser “bookmarks” and “history” functions are the least commonly used tools on web browsers for navigating within a website (Aula et al., 2005).

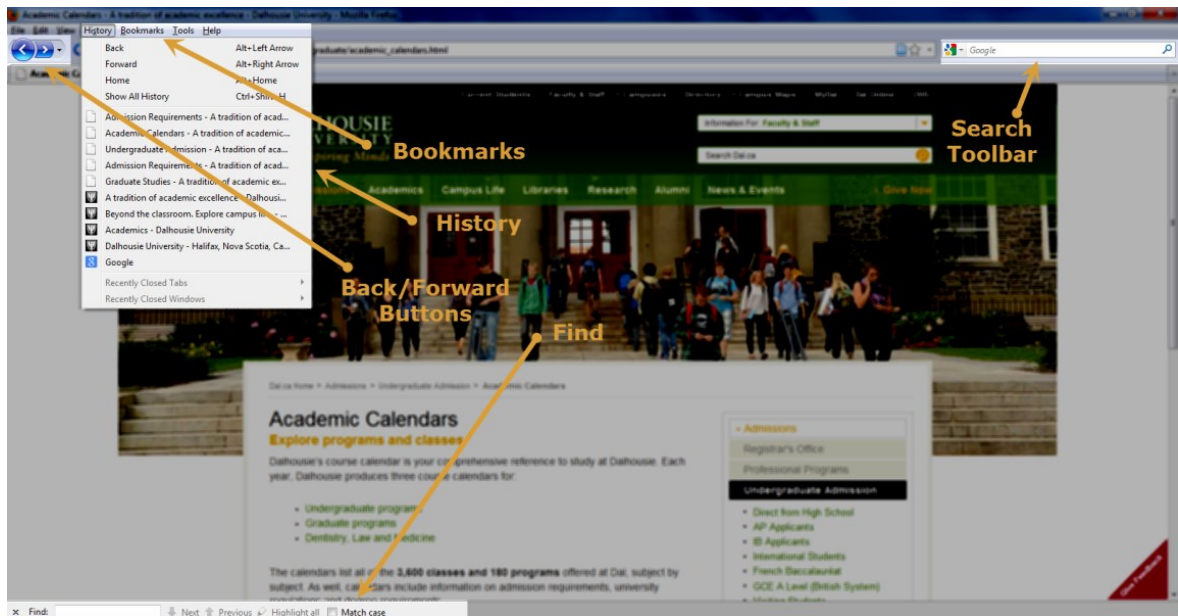


Figure 2.4 - Browser navigation mechanisms for Mozilla Firefox

Even though the navigation mechanisms provided as part of the web browser assist in navigating within websites, there is little research examining website links that are shared externally (i.e., on other sites like social media sites).

### 2.2.3 External Links

The web thrives on the collection of web pages and links pointing from one web page to another. External links are those that point to a target website (including specific pages) from outside (i.e., external websites and not the target website). These links help users find information on the target website. The importance of links from external websites,

especially credible websites, to the target website plays a crucial role in the ranking of a website or a web page (Page et al., 1999). This ranking is used by search engines while retrieving relevant web pages based on the search criteria. Among these external websites are social media sites such as Facebook, YouTube, Google+, Twitter, etc. which are described in the next section.

### **2.3 Social Media**

Social media are websites where people interact with others by sharing and discussing information in the form of words, pictures, videos and audios. They appear in many forms including blogs and microblogs, forums and message boards, social networks, wikis, social bookmarking etc. Some of the social media sites include Twitter, Facebook, YouTube, LinkedIn, Google+, Snapchat, MySpace, Pinterest, Instagram, Flickr, Reddit, Tumblr, etc.

Facebook, founded in 2004, has over 1.35 billion monthly active users (Facebook, 2014) and is the largest social network in the world. It provides a platform for users to share and connect with friends and family. YouTube, founded in 2005, has over 1 billion monthly active users (YouTube, 2014) and is the second largest social network in the world. It allows users to discover, watch and share videos and provides a platform for people to connect, inform and inspire others. Google+, founded in 2011, has over 540 million monthly active users (Google, 2014) and is the third largest social network in the world. Google+ helps users connect to others that share similar passion with communities. Twitter, founded in 2006, has over 284 million monthly active users (Twitter, 2014) and is the fastest-growing social media platform in the world. It enables users to post messages, also known as “tweets”, of up to 140 characters.

Over the years, the percentage of males and females using social media has grown tremendously. Three-quarters (74%) of online females use social networking sites (Duggan, 2013). Figure 2.5 shows the distribution of men vs. women who use different social networking sites. Across different sites, men and women have varying degrees of

engagement. Women are significantly more likely than males to use Facebook, Pinterest, and Instagram, roughly equal proportion of men and women use Twitter and Tumblr, and Reddit is used by more men than women.

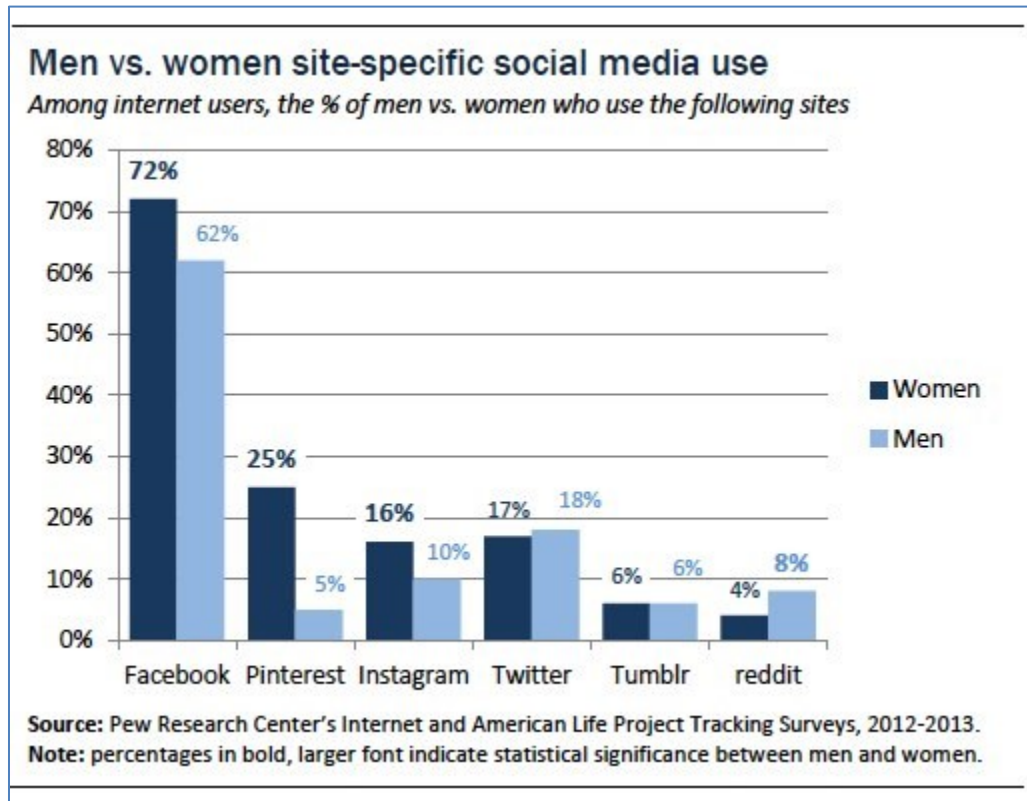


Figure 2.5 – Men vs. Women site-specific social media usage (Dugann, 2013)

Social media is rapidly changing how we access and consume information on the web. It is also having a significant impact on how collaborative relationships are formed and information is disseminated (Gruzd and Goertzen, 2013). Since the adoption of social media sites by billions of users on the web, social media has generated tremendous volume of user-generated data that can be analyzed and mined for research purposes as they are valuable information sources (Teevan et al., 2011). This in its simplest form can be classified as social discovery as described by Shneiderman (2011). The Reader-to-Leader framework (see Figure 2.6) suggests a typical path of social media participation which moves from reading online content to making contributions (from small edits to substantial contributions), which is what these social media sites allow. Through the use of Application Programming Interface (APIs), researchers have been able to collect and

analyze social media data for better understanding of user behavior on social media, especially in the field of marketing.

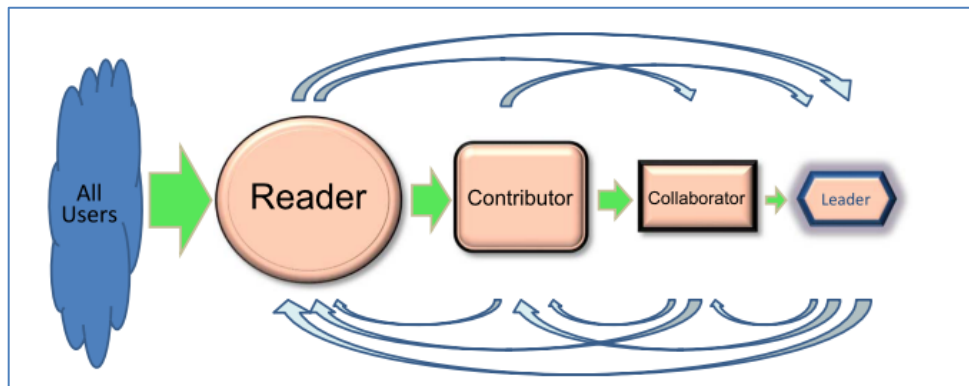


Figure 2.6 - Reader to Leader framework (Shneiderman, 2011)

Twitter is a platform to share and disseminate information and more and more researchers are interested in mining and analyzing tweets. Cheong and Lee (2009) refer to it as a collective source of intelligence that can be used to obtain opinions, ideas, facts and sentiments. Hughes and Palen (2010) focused on the use of Twitter during crises situations. They examined four high impact events – two emergency and two national security and statistically examined how Twitter is used during those events and compared how that behavior is different from general Twitter use. They found that Twitter messages sent during these types of events contained more instances of information broadcasting while general Twitter use offered more instances of information sharing. Bruns and Liang (2012) also studied Twitter data during natural disasters. They proposed an infrastructure for tracking and analyzing twitter feeds in close to real-time. Bruns and Stieglitz (2012) conducted a comparative study on a large number of communicative events (40) ranging from elections, natural disasters, corporate crises to television events. They showed that thematic and contextual factors influence the use of different communicative tools available on Twitter, such as original tweets, @replies, retweets and URLs. Gupta and Kumaraguru (2012) developed credibility ranking algorithms for tweets during high impact events. Teevan et al. (2011) explored search behavior on

Twitter and discovered the Twitter search queries are shorter, more popular, and less likely to evolve as part of a session than web queries.

Early on Twitter users began providing links to outside content by including the URL in their tweets (Boyd et al., 2010). This is useful as the 140 character limit can be constricting for those who want to convey large amount of information. Because URLs are generally long, people use URL shortening tools, such as Bit.ly (<http://bit.ly>) to abbreviate URLs which when clicked redirects the user to the desired web page. White et al. (2013) examined the types of links shared on Twitter and found that in a data set of #tarsands tweets, 29.2% of the tweet contained links to articles and 22.6% contained links to websites. Hughes and Palen (2010) found that in general 25% of tweets include a URL but the frequency is higher (40-50%) during emergencies such as hurricanes and high impact events. Lovejoy et al. (2012) discovered that majority of the non-profit organizations are using Twitter to distribute messages and 68% include links to external sites. Wu et al. (2011) found that 50% of URLs consumed are generated by just 20K elite users and that longest-lived URL are dominated by content such as videos and music.

The evidence of link sharing on Twitter is highlighted by these studies. The importance of link sharing on Twitter has been further analyzed and shown to be an effective strategy for driving traffic to a web page from outside (Suster, 2011). Due to the availability of the Twitter APIs and it being the fastest-growing social network in the world, it is used as a primary social media site in this research. We examine how using links shared on Twitter may help users navigate to specific web pages within a target website.

## **2.4 Information Seeking Tasks**

Research in the area of how users navigate and interact on the web shows a large dependency on the type of task (Saito et al., 2009). Broder (2002) provided a taxonomy of web searches and classified web queries into three classes: navigational (the intent to reach a particular site), informational (the intent to acquire some information assumed to be present on one or more web pages), and transactional (the intent to perform some web-

mediated activity). Saito et al. (2009) compared a report-writing task (informational) with a trip planning task (transactional) and found that the type of task and the level of experience did affect participants' search behaviors. Terai et al. (2008) examined the influence of task types on information seeking behaviors on the web and used two types of web search, an informational task and a transactional task and also concluded that the type of task affected the participants' information seeking behaviors. For transactional tasks, participants visited more web pages than for the informational tasks, but their reading time on each page was shorter than in the informational tasks. The categorization of tasks based on Broder's taxonomy of web searchers provided insight on how search engines evolved to deal with web-specific needs.

Researchers interested in the characterization of user activity on the web often look to models of information seeking (Ellis, 1989; Marchionini, 1995; Choo et al., 2000, Morrison et al., 2001, Sellen et al., 2002, Rozanski et al., 2001). While these models provide a good characterization of users' information seeking activities, there are a number of activities that are not described by these models. Using these models as a basis, Kellar et al. (2007) derived the following five categories: fact finding (looking for facts, files or specific pieces of information, possible on one page), information gathering (collecting information from multiple sources, in order to make a decision or write a report), browsing (viewing web pages with no specific goal in mind, serendipitous information seeking), transactions (an online action, such as email or banking) and other (all tasks that do not fit in the above categories). They conducted a field study in which participants were asked to annotate all web usage with a task description and categorization. Based on the analysis, they developed a classification of web information tasks, consisting of three information goals: information seeking, information exchange, and information maintenance, as shown in Figure 2.7. Information seeking tasks consist of fact finding, information gathering, and browsing. Information exchange tasks consist of transactions and communications. These are tasks in which the user's goal is to exchange information in a web-based setting, such as banking and/or facilitate web-based communication, such as email, online bulletin boards, or web-based publishing such as

blog postings. Information maintenance consists of “other” tasks, such as maintaining the web page, ensuring content appears as they should, links are working properly, as well as updates to user profile.

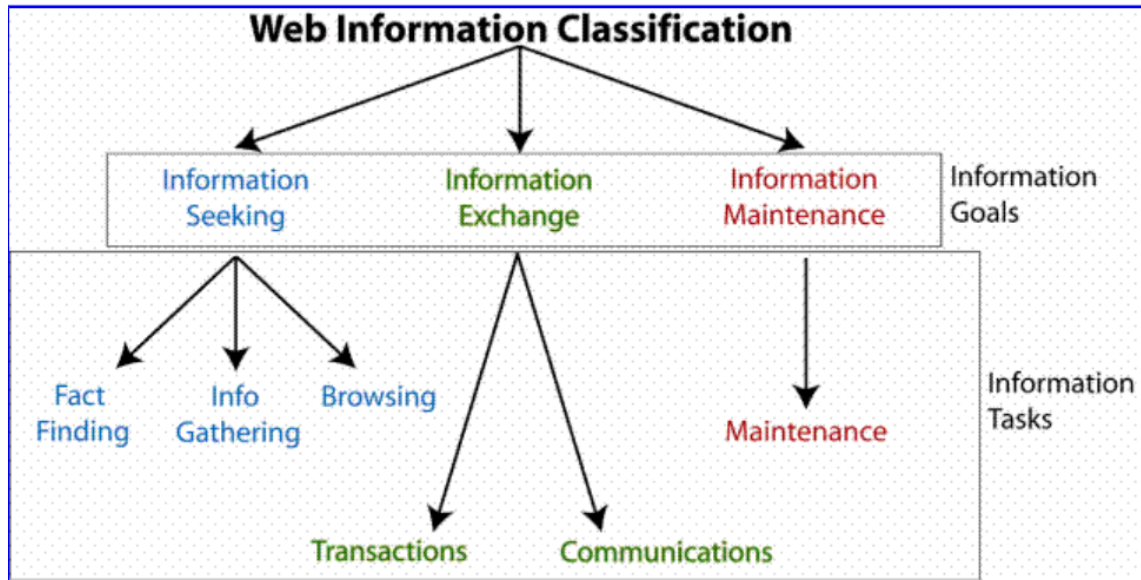


Figure 2.7 - Web information classification model (Kellar et al., 2007)

The results from this research provided a breakdown of tasks participants performed over the week long study, as shown in Figure 2.8.

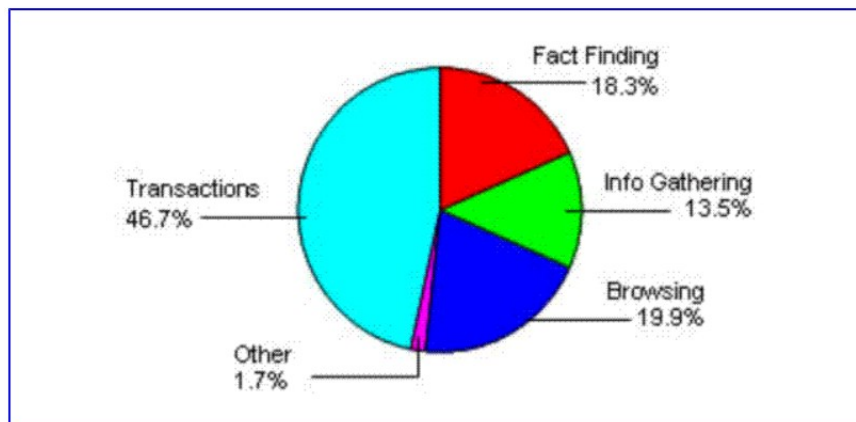


Figure 2.8 - Breakdown of all task captured (Kellar et al., 2007)



The findings from the study illustrates that the transactional tasks were the most frequently recorded tasks for 46.7% of all web usage and were made up of email, online bill payment, and blog entries. Browsing tasks accounted for 19.9% of all web usage, fact finding accounted for 18.3% of all web usage, information gathering accounted for 13.5% of all web usage and 1.7% were classified as other tasks. Since we are interested in improving navigation in a website which does not correspond to checking or responding to emails or bill payments, we do not consider transactional tasks in our research. Instead we focus on the next two most used web tasks, namely fact finding and browsing.

## **Chapter 3 – Research Methodology & Design**

This chapter describes the overall approach to the research, the research methodologies and the software packages used in the studies.

### **3.1 Overall Research Approach**

The research focuses on the collective examination of current navigation tools within websites and the use of link sharing data from social media sites for the purpose of improving navigation within websites. Our research aims to do the following:

- a. Gain a better understanding of how users use current navigation tools within websites by collectively examining menus, search and tag clouds and further examining the two types of tag clouds: single author-driven and community of authors-driven (Phase 1).
- b. Gain a better understanding of the characteristics of website links shared on social media, specifically Twitter, by collecting and analyzing links to target websites. Develop a set of guidelines and a prototype (Phase 2) using the findings from Phase 1 and this study,.
- c. Evaluate the set of guidelines and the prototype by conducting a focus group and a user study (Phase 3).

To meet the above three objectives, the research methodologies for this thesis included elements of both qualitative and quantitative approaches, also called mixed methods research.

### **3.2 Why Mixed Methods?**

The use of mixed methods provides an enhanced understanding of the questions at hand and results in a more complete set of findings. There are a number of strengths and limitations of mixed method research. Some of the strengths include:

- comprehensive analysis – use of both qualitative and quantitative approaches in combination, provides a better understanding of the research problems than either approaches alone
- validity (more evidence) – allows for corroborating qualitative and quantitative data
- offsets limitations of one method with strengths of another
- explanation – qualitative data can help explain quantitative data or vice versa
- enhances integrity of findings

Some of the limitations include:

- extensive data collection
- time-intensive analysis for both text and numeric data
- potential for contradictory findings

Despite the limitations, mixed methods are used in research (Chadwick et al., 1984; McGrath, 1995; Burdette, 2000; Choo et al., 2000; Boardman and Sasse, 2004; Mahmud, 2006; Morris et al., 2008). The strengths of mixed methods met our research objectives, which were to gather a holistic view of how users use navigation mechanisms within websites. Qualitative research methods were used to analyze questionnaires, semi-structured interviews and focus groups. Quantitative research methods were used to analyze numeric data (time and number of clicks to complete the tasks).

### **3.3 Research Design**

This research was conducted in three phases. Phase 1 began with an investigative study to better understand how users use current navigation mechanisms within websites. A controlled user study was conducted to collect both qualitative and quantitative data. The findings from Phase 1 provided a better understanding of how users use current navigation tools and their perception of these tools which helped create a set of guidelines. It was also determined that they preferred tag clouds (i.e., community's involvement in assisting with navigation) over menus, however, disliked certain features of tag clouds (such as similarity between tags etc.). Considering that the tag clouds were

useful and perceived to be effective and efficient, it was decided to proceed to the next phase of the research which was to explore community driven content that exists on the web, namely social media sites. Twitter messages (i.e., tweets) were collected and analyzed, during four events, to determine the characteristics of links that were shared on social media. This information helped expand the set of guidelines developed as part of Phase 1. Using these guidelines, a prototype was developed. In Phase 3, the prototype was evaluated via a focus group which helped refine the prototype and conduct a controlled user study in a lab environment.

The decision to conduct controlled user studies for Phase 1 and 3 of the research, was derived from previous researchers who used controlled lab experiments to test browser tools (Robertson et al., 1998; Wexelblat and Maes, 1999; Amento et al., 2000; Nadeem and Killam, 2001; Sørensen et al., 2001; Cockburn et al., 2003; Milac-Frayling et al., 2003; Jhaveri and Rähä, 2005; MacKay et al., 2005; O'Brien, 2011). The main advantage of this approach is that the researcher can control the independent and dependent variables by controlling extraneous variables. An independent variable is “the factor that is measured, manipulated, or selected by the experimenter to determine its relationship with to an observed phenomenon” (Tuckman, 1999). A dependent variable is “a response variable or output” (Tuckman, 1999). This helps test specific factors and collect data (Sommer and Sommer, 1986), however, the decrease in context within a real environment makes it more difficult to generalize the results (McGrath, 1995).

### 3.4 Software Packages Used

Several software packages were used to collect and analyze data during the three phases of the research. **Opinio**, an online survey software, was used to collect participant’s informed consent and responses to demographic questionnaires, post-task questionnaires and post-study questionnaires. **Team Viewer 9**, a remote desktop software, was used to remotely observe participant’s on-screen activity while they completed their tasks. **Morae**, a usability testing software, was used to record participant’s on-screen activity including time and number of clicks during the study. It was also used after the study to

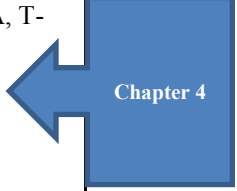
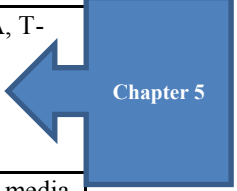
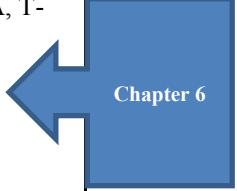
observe participant's onscreen activity. Participant's ability to get to the desired web page successfully (i.e., effectiveness) was determined using these tools. **Netlytic**, social network analyzer, was used in Phase 2 and 3 of this research to collect data from Twitter.

Several software packages were utilized to analyze the data. For qualitative analysis, **NVIVO 10**, qualitative data analysis software, was used to code and categorize participant's responses to open-ended questions and semi-structured interviews. For quantitative analysis, **IBM SPSS Statistics 22**, a statistical software, was used to conduct descriptive statistics, z-test, t-tests and ANOVA. Participant's ability to get to the desired web page (measured in time and number of clicks) was determined using this tool. The prototype was built using AXURE RP Pro 7.0.

### **3.5 Summary**

The overall approach to the research and the research methodologies are described in this chapter. Table 3.1 describes the three phases, the methods used, the collection and analysis tools used and the outcomes of each of three phases of the research.

Table 3.1 – Research design, methods and outcomes

Phases	Type of Study	Methods	Data Collection Tools	Data Analysis Tools	
<b>Phase 1: Preliminary Study</b>	Controlled User Study	Qualitative + Quantitative	<ul style="list-style-type: none"> <li>• Questionnaires (demographic, post-task, post-study)</li> <li>• Semi-structured interviews</li> <li>• Morae (number of clicks and time)</li> </ul>	<ul style="list-style-type: none"> <li>• SPSS (ANOVA, T-Test)</li> <li>• Morae</li> </ul>	 <p>Chapter 4</p>
<p><b>Outcome of Phase 1:</b> Better understanding of the current navigation tools. Both qualitative and quantitative data showed that participants found tag clouds to be efficient and effective. However, community's participant in tagging content can be problematic. Developed a set of guidelines for improving navigation tools based on the results. Popular events for Phase 2 were chosen based on the results of Phase 1.</p>					
<b>Phase 2: Link Analysis Study</b>	Data Analysis (Links)	Quantitative	<ul style="list-style-type: none"> <li>• Netlytic</li> <li>• PHP scripts</li> </ul>	<ul style="list-style-type: none"> <li>• SPSS (ANOVA, T-Test)</li> </ul>	 <p>Chapter 5</p>
<p><b>Outcome of Phase 2:</b> Better understanding of the characteristics of links shared on social media referring to the target website as well as external websites. Developed the characteristics of websites to use for Phase 3. Developed a prototype based on findings from Phase 1 and Phase 2.</p>					
<b>Phase 3: Final Study</b>	Focus Group & Controlled User Study	Qualitative + Quantitative	<ul style="list-style-type: none"> <li>• Questionnaires (demographic, post-task, post-study)</li> <li>• Semi-structured interviews</li> <li>• Morae (number of clicks and time)</li> </ul>	<ul style="list-style-type: none"> <li>• SPSS (ANOVA, T-Test)</li> <li>• Morae</li> <li>• NVivo</li> </ul>	 <p>Chapter 6</p>
<p><b>Outcome of Phase 3:</b> Added to the set of guidelines created in Phase 1. Refined the SMP prototype. The SMP prototype was found to be effective, efficient and engaging for browsing tasks. The quantitative analysis also showed that participants performed fact finding tasks faster than browsing tasks. It was statistically proven that it took fewer number of clicks to complete the task using SMP. However, the use of SMP did not prove to make a significant difference in expediting the completion of the task.</p>					

## Chapter 4 – Phase 1: Preliminary Study

This chapter provides the details of the first phase of this research which is a preliminary study to better understand the current navigation mechanisms within websites, namely menus, search and tag clouds. We conducted a controlled user study (Nizam et al., 2012a, 2012b) using mixed methods. The results of the preliminary study, along with the motivation to proceed to Phase 2 of the research, are outlined in this chapter.

### 4.1 Study Objectives

The primary objective of this study was to develop an in-depth understanding of how users navigate websites using traditional (menus and search) and social (tag clouds) navigation tools for simple information seeking tasks. Simple information seeking tasks are defined as those that require judgement in choosing the results but do not require complex decision making, rating of results, or extensive memory. Effectiveness (i.e., task completion) and user engagement (i.e., user preference) were measured to gather insights.

The secondary objective of this study was to compare two variations 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). Differences in efficiency (i.e., time and number of clicks to complete the given task) were compared to determine the most efficient one in finding information.

### 4.2 Research Questions

The following research question was considered for this study:

**RQ1:** How do users use website navigation tools (search, menu and tag cloud) for simple information seeking tasks?

- a. Which of three navigation tools (search, menu and tag cloud) are perceived to be more effective, efficient and preferred in finding information for simple information seeking tasks?

- b. Which of the two types of tag cloud (single author-driven vs. community of authors-driven) is more efficient and preferred in finding information for simple information seeking tasks?

### 4.3 Research Methodology

This study was conducted using mixed methodologies, where both qualitative and quantitative data was collected and analyzed in a controlled user study. Questionnaires, semi-structured interviews, and on-screen recordings were used to collect data. Morae, SPSS and Microsoft Excel were used to analyze data. An approval from the Dalhousie University Social Sciences and Humanities Research Ethics Board was acquired before commencing the study (see Appendix 4.A).

#### 4.3.1 Website and Tasks

Four websites were selected to conduct this study. The following three criteria were considered:

1. The website must contain all the three navigation tools being studied (i.e., menus, search and tag cloud). An example displaying all the three tools on a website is illustrated in Figure 4.1.

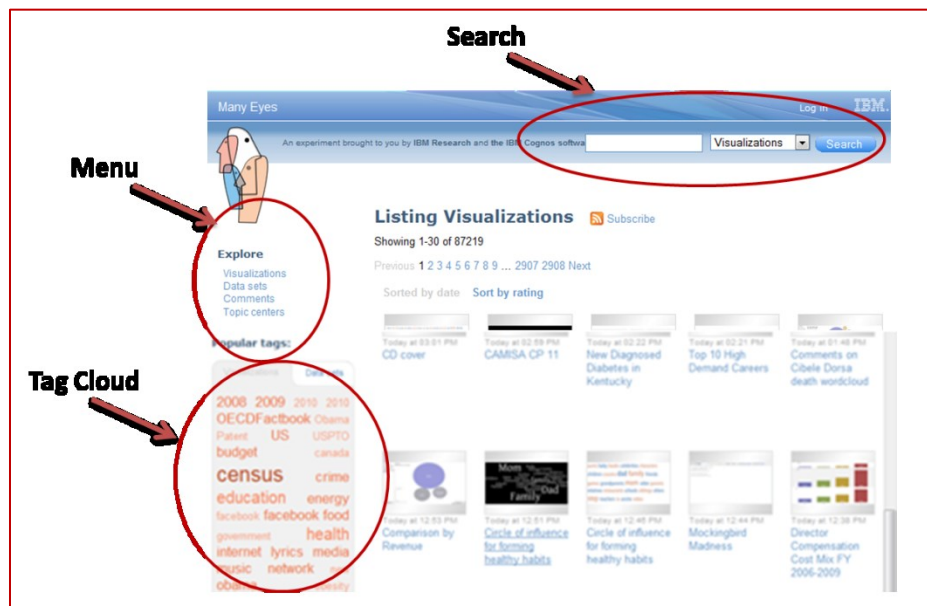


Figure 4.1 – “Many Eyes” website consisting of all three navigation tools



2. Tag Cloud must be single user or community driven.
3. Traditional and social navigation tools must be displayed on all pages of the website (i.e., home and sub-pages).

A focus group was conducted to select the four websites and their subsequent tasks. The following four websites were selected:

### **1. Professional on the Web**

The purpose of the Professional on the Web website is to profile companies/professionals who offer web services, such as: web design, web development, search engine optimization etc. Companies/professionals create their profile and also create tags for their services which in turn contribute towards the creation of the tag cloud on the website. Hence the tag cloud on this website is community driven. Participants were asked to find two companies that they would consider hiring to redesign Government of Nova Scotia's website.

### **2. Many Eyes**

The purpose of the Many Eyes website is to allow users to create and share visualization on the web. Users assign tags to their visualizations and these tags contribute towards the creation of the tag cloud on the website. Hence the tag cloud on this website is also community driven. Participants were asked to find two visualizations that would be beneficial for their project on alcohol consumption and its effects.

### **3. Web Designer Wall**

The Web Designer Wall website is a blog of web design ideas, trends and tutorials. The website is maintained by a single user. The tag cloud is generated using a plug-in and is based on content produced by the blogger. Hence the tag cloud is single author-driven. Participants were asked to find information on how to design a website for mobile devices.

#### 4. Technology Education Know-How

The Technology Education Know-How is also a blog with the purpose of helping teachers use technology as a resource in their teachings. The content is tagged by the blogger and hence the tag cloud is single author-driven. Participants were asked to find two posts to assist their friend who is a 4th grade teacher and is interested in resources to supplement his teaching.

Table 4.1 illustrates these four websites along with their tasks and the type of tag cloud represented. Figure 4.2 shows the screenshot of the home page along with the navigation tools for each website.

Table 4.1 – Four websites, tasks and the type of tag cloud (SA or CA)

Website	Description	Type of Tag Cloud
<b>Professional on the Web</b>	Companies/professionals create their profile and also create tags for their own services. <b>Task:</b> <i>Find two companies that you would consider hiring to redesign a website.</i>	CA
<b>URL:</b> <a href="http://www.professionalontheweb.com/">http://www.professionalontheweb.com/</a>		
<b>Many Eyes</b>	Users create/share visualizations. Users assign tags to their own visualizations. <b>Task:</b> <i>Find two visualizations beneficial for your project on alcohol consumption and its effects.</i>	CA
<b>URL:</b> <a href="http://www-969.ibm.com/software/analytics/manyeyes/">http://www-969.ibm.com/software/analytics/manyeyes/</a>		
<b>Web Designer Wall</b>	A blog of web design ideas, trends and tutorials. Maintained by a single author who tags the blog entries. <b>Task:</b> <i>Find two posts on how to design a website for mobile devices.</i>	SA
<b>URL:</b> <a href="http://webdesignerwall.com/">http://webdesignerwall.com/</a>		
<b>Technology Education Know-How</b>	A blog to help teachers use technology. Maintained by a single author who tags the blog entries. <b>Task:</b> <i>Find two posts to assist your friend (4th grade teacher) with resources to supplement his teaching.</i>	SA
<b>URL:</b> <a href="http://www.techedknow.com/">http://www.techedknow.com/</a>		



Figure 4.2 – Home page screenshots of four websites with the three navigation tools

### 4.3.2 Study Design

A controlled user study was conducted in a lab environment. Participants were asked to complete four tasks, a task on each of the four websites. Two of the tasks, allowed participants to use any or all of the three navigation tools, whereas the remaining two tasks allowed them to only use tag clouds. The websites along with their tasks were counterbalanced in order to account for the order effect. It was a within-subject experiment in terms of the website (all participants used all four websites) but a between-subject experiment in terms of the tasks, as illustrated in Table 4.2 and Figure 4.3.

Table 4.2 – Order of tasks

Participant ID	Task 1	Task 2	Task 3	Task 4
1, 5, 9, 13	Website 1	Website 2 (with Tag Clouds)	Website 3	Website 4 (with Tag Clouds)
2, 6, 10, 14	Website 2	Website 1 (with Tag Clouds)	Website 4	Website 3 (with Tag Clouds)
3, 7, 11, 15	Website 3	Website 4 (with Tag Clouds)	Website 1	Website 2 (with Tag Clouds)
4, 8, 12, 16	Website 4	Website 3 (with Tag Clouds)	Website 2	Website 1 (with Tag Clouds)

Website 1: Professional on the Web

Website 2: Many Eyes

Website 3: Web Designer Wall

Website 4: Teaching Education Know-How

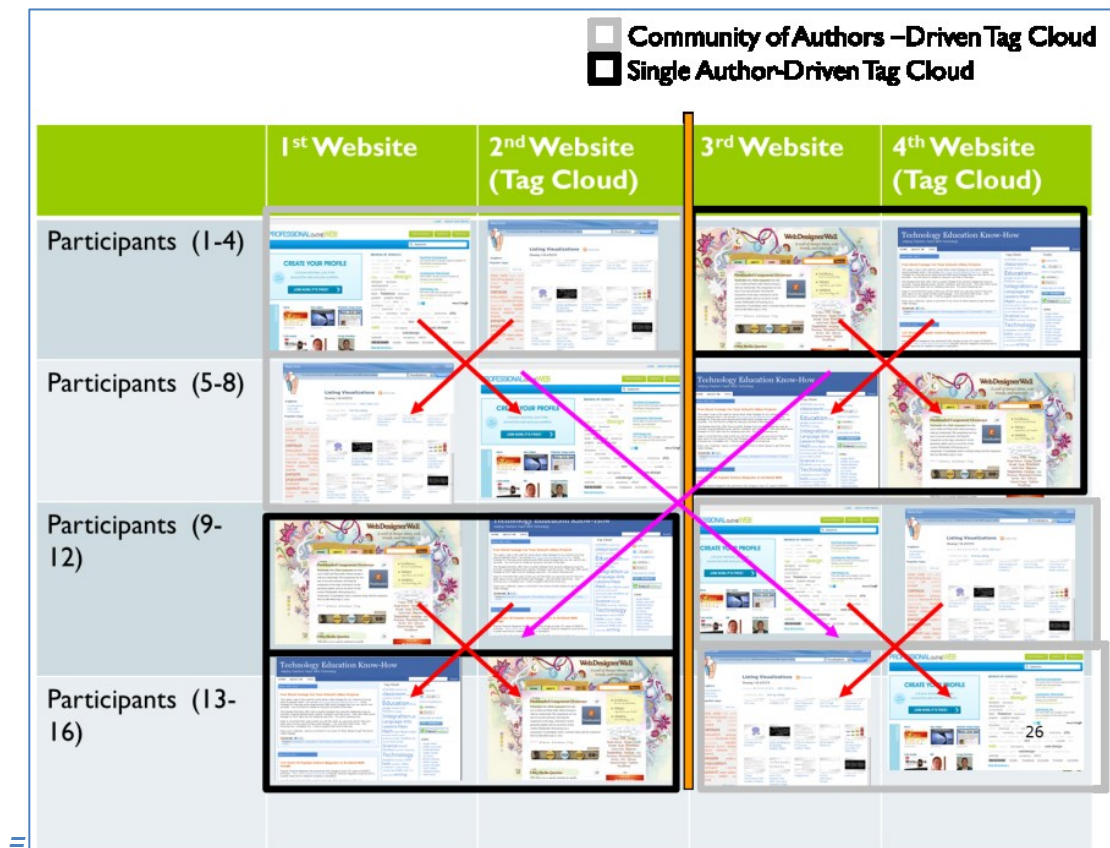


Figure 4.3 – Study design and the controlled ordering of tasks on the four websites

The study began with participants filling out a background questionnaire consisting of demographic questions and previous experience of using navigation tools within websites, followed by a training session on the three tools in random order, in order to eliminate bias. The website used for training was a blog website called EverythingFlex (<http://blog.everythingflex.com/>) which included all three navigation tools (menu, search and tag cloud). Participants were then asked to conduct four simple information seeking tasks on each of the four websites. After each task, participants completed a post-task questionnaire and after all four tasks, they completed a post-study questionnaire. The study concluded with a semi-structured interview session, where participants were asked a series of questions to elaborate on their experience of using the three navigation tools and the two types of tag cloud.

Students from the Dalhousie Faculty of Computer Science were recruited to participate in this study. The study was conducted in the Usability Lab of Dalhousie's Computer Science building where participants used Firefox 3.6 on a desktop computer. Team Viewer was used to observe participant's on-screen activity while they conducted the tasks and Morae to record participant's on-screen activity and responses to questionnaires.

#### **4.4 Results**

Fourteen Computer Science students (thirteen males and one female) participated in this study. The majority of the participants (79%, 11/14) were between the ages 21 to 30 and 57% (8/14) were graduate students. The majority of the participants (93%, 13/14) had used search and menus within websites, whereas only one participant had used tag clouds prior to the study. Table 4.3 provides the data points (i.e., the number of participants in each condition) which were collected for each website in the two categories of tag clouds (community driven and single author driven):

Table 4.3 – Data points for each condition

Condition	Community of Authors Tag Cloud (CA)		Single Author Tag Cloud (SA)	
	Website 1	Website 2	Website 1	Website 2
1. All 3 navigation tools allowed (menus, search and tag clouds)	8	6	8	6
2. Only tag cloud allowed	6	8	6	8

#### 4.4.1 Effectiveness

Effectiveness corresponds to the completion of the task. All fourteen participants were able to complete the task using the three navigation tools. Figure 4.4 illustrates the individual navigation tools used as well as the combination of navigation tools used during the study.

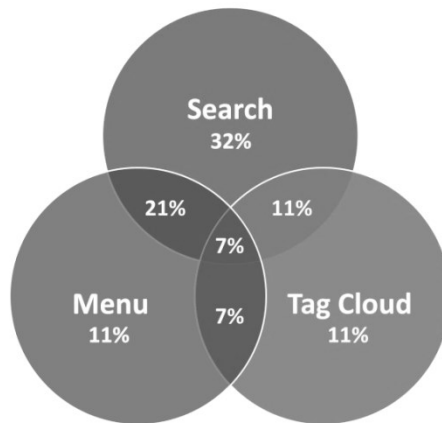


Figure 4.4 – Usage of navigation tools during the study

When participants were asked which tool they thought retrieved the most relevant results; 43% (6/14) indicated search, 43% (6/14) selected tag clouds and only 14% (2/14) selected menus, as illustrated in Figure 4.5.

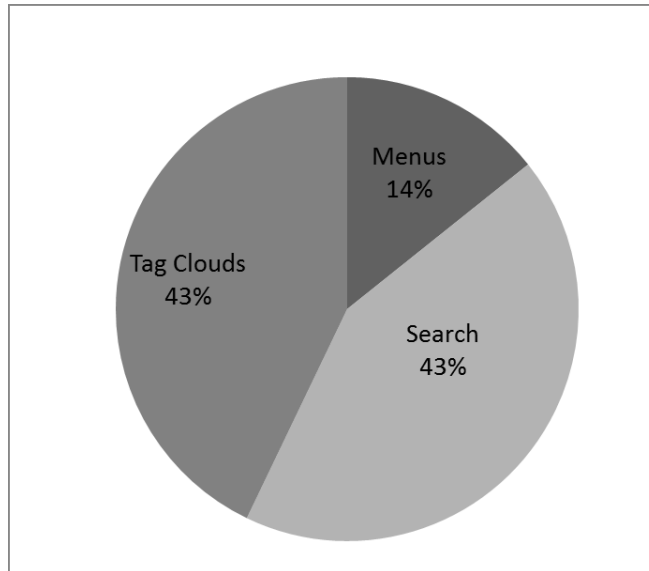


Figure 4.5 – Participants’ perception on tools with best results

#### 4.4.2 Efficiency

Two metrics were used to measure efficiency: one was the time to complete the task and the other was the number of clicks taken to complete the task. On average it took participants 3 minutes and 16 seconds to complete a task when they had the option to use any of the three navigation tools.

An independent sample t-test was used to see if the data points for the two websites in each of the two categories of tag clouds could be combined. For the time to complete and the number of clicks, the t-test level of significance was greater than 0.05 for both conditions, as illustrated in Table 4.4. Therefore, the data points for the two websites in each of the tag cloud category were combined to result in 14 participants in each condition, as illustrated in Table 4.5.

Table 4.4 – Independent sample t-test for each type of tag cloud (CA and SA)

Condition	Community of Authors Tag Cloud (CA)		Single Author Tag Cloud (SA)	
	Website 1	Website 2	Website 1	Website 2
3. All 3 navigation tools allowed (menus, search and tag clouds)	Time to Complete: 0.507 Number of Clicks: 0.947		Time to Complete: 0.713 Number of Clicks: 0.678	
4. Only tag cloud allowed				

Table 4.5 – Data points for each type of tag cloud (CA and SA)

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

Participants took on average 3 minutes and 16 seconds to complete the tasks when all three navigation tools are permissible to use. When using only tag clouds, it took participants an average of 3 minutes and 3 seconds to complete the task when the tag cloud was single author-driven, whereas it took 4 minutes and 33 seconds when the tag cloud was community of authors-driven. As illustrated in Figure 4.6.

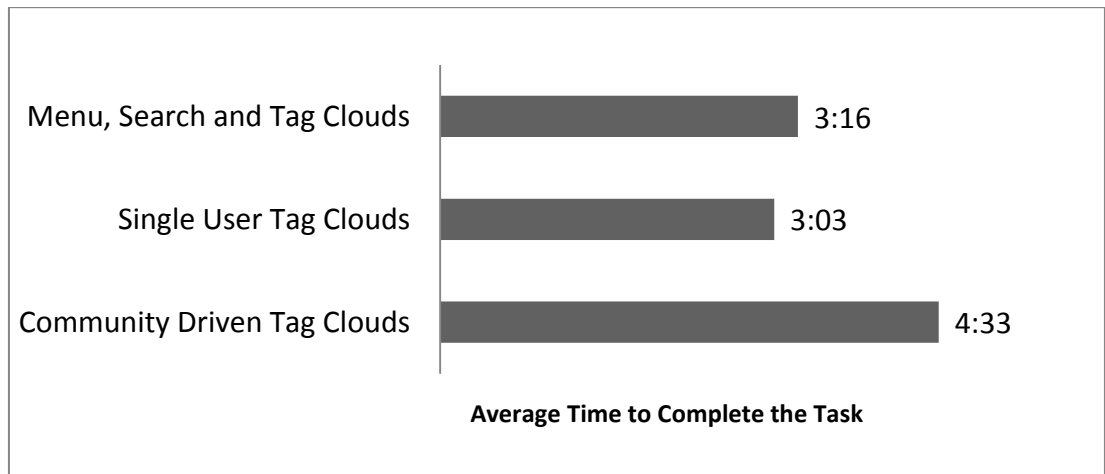


Figure 4.6 – Average time to complete the task (in seconds)



The number of clicks taken to complete the task was measured using Morae Manager. It took participants an average of 19 clicks to perform the task when presented with the option to use any of the three navigation tools. When using only the tag clouds, it took participants an average of 12 clicks to complete the task when the tag cloud was single author-driven, whereas it took 29 clicks when the tag cloud was community of authors-driven, as illustrated in Figure 4.7.

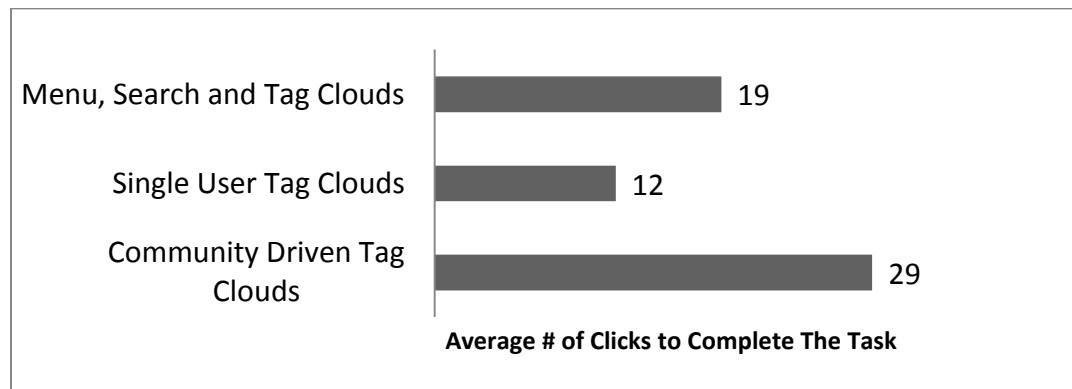


Figure 4.7 – Average number of clicks to complete the task

In order to determine if the differences in the time to complete the task and the number of clicks taken to complete the task between the two variations of tag clouds were statistically significant, a one-way analysis of variance test (ANOVA) was conducted.

The results showed that the mean time to complete the task using community of authors-driven tag clouds ( $M=4:35$ ,  $SD=2:45$ ) and the single author-driven tag clouds ( $M=3:00$ ,  $SD=1:37$ ),  $[F(1,26) = 3.435, p=0.075]$  was not statistically significant at the 0.075 level. However, the number of clicks used to complete the task was statistically significant. The results showed that the mean number of clicks to complete the task using community of authors-driven tag clouds ( $M=28$ ,  $SD=17$ ) is significantly different at the 0.002 level from the mean number of clicks using single author-driven tag clouds ( $M=12$ ,  $SD=8$ ),  $[F(1,26) = 11.605, p=0.002]$ . It was concluded that the difference between the mean is statistically significant and that single author-driven tag clouds required fewer clicks than

community of authors-driven tag clouds. Community of authors-driven tag clouds took on average an extra 16 clicks to complete the task (about twice).

#### 4.4.3 User Engagement

User engagement corresponded in this study to participant's preference and experience of using the tools. One of the goals of the post-task questionnaire was to gather participant's experience and whether they found the task to be enjoyable or frustrating. A 1-to-5 rating Likert scale question was used to gather this information. The majority of the participants (64%, 9/14) found single author-driven tag clouds to be the most enjoyable to use compared, whereas 43% (6/14) found community of authors-driven tag cloud to be enjoyable. Interestingly, participants found community of authors-driven tag cloud to be the most frustrating (29%; 4/14) compared to single author-driven tag clouds (14%; 2/14), as illustrated in Figure 4.8.

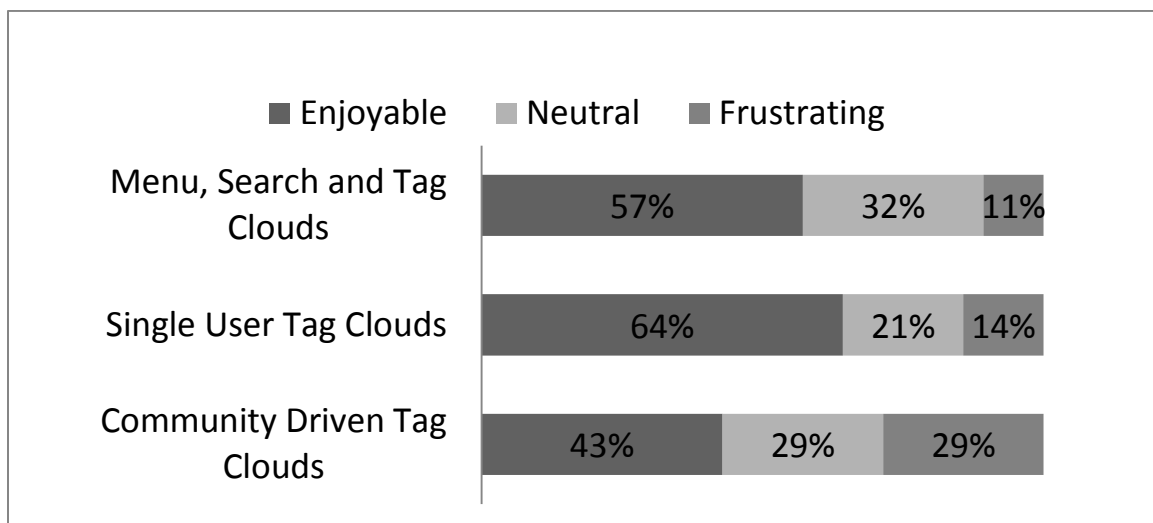


Figure 4.8 – Participants experience of finding information

The interview session revealed participant's perception of the three tools after conducting the study. It was determined that participants found search to be the most preferred and easiest to use. Tag clouds were the most efficient, as illustrated in Figure 4.9.

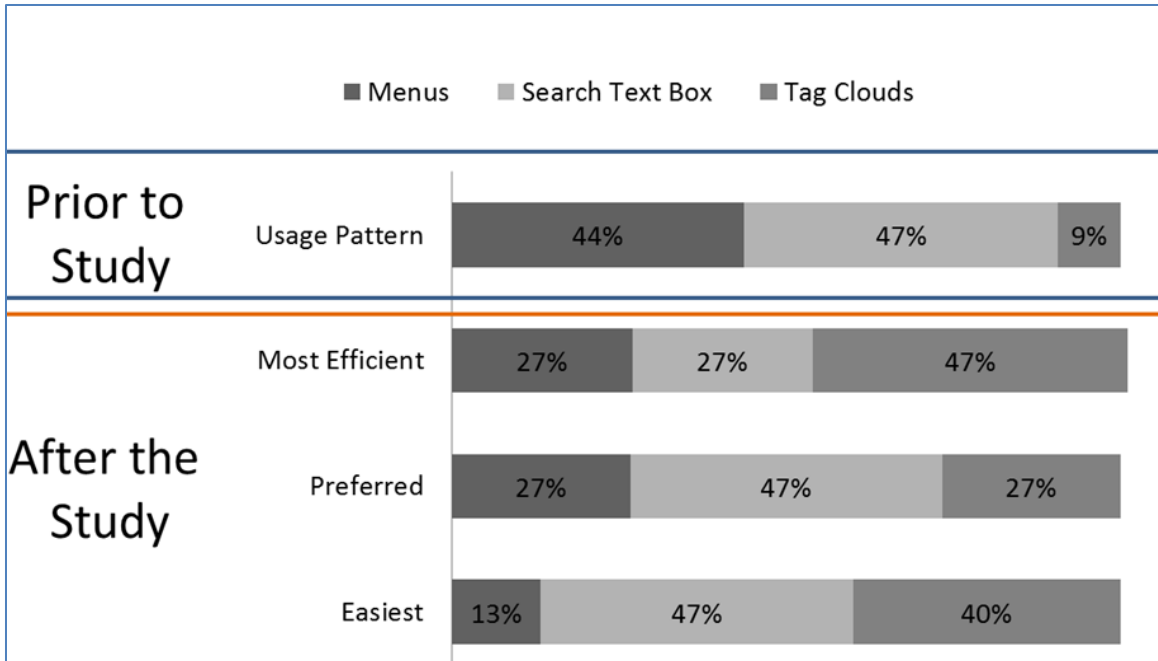


Figure 4.9 – Participants perception of the navigation tools

The interview session also 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. 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, it was gathered that only one participant 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.

#### 4.4.4 Additional Findings

Additional information captured from the interview session highlights the following: 75% (10/14) would have preferred using search, when asked to use only the tag cloud to accomplish the task, 66% (9/10) thought that if they had the option of only using one navigation tool within websites, they would have preferred using search. All participants thought websites should have multiple navigation tools, with 36% (5/14) wanting at least two. Figure 4.10 illustrates participants’ opinion on the number of navigation tools which

should be on a website. Furthermore, participants were asked what they liked and disliked about the three navigation tools. Here are the findings:

**Search:** Participants preferred the flexibility of forming a search query based on information need. Furthermore, they found it easy to use. They disliked the time it required to enter the query (keywords) and the retrieval of sometimes non-relevant results.

**Menus:** Participants found menus helpful due to their structured format. They were familiar with the tool and thought menus were easily accessible, due to the prominent location of menus on most websites. They disliked using menus when they are poorly labeled or when they are not exhaustive.

**Tag Clouds:** Participants thought tag clouds were 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 within 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.

#### **4.5 Summary of Findings**

The analysis from both qualitative and quantitative data suggests that search and tag clouds, especially where tags were created by a single author, were effective, efficient and considered to be the preferred navigation tool to find information within websites. Table 4.6 provides a summary of these findings.

Table 4.6 – Summary of findings in relation to the research questions

<b><i>RQ1: How do users use website navigation tools (search, menu and tag cloud) for simple information seeking tasks?</i></b>				
	<b>Menus</b>	<b>Search</b>	<b>Tag Clouds</b>	<b>Combinations of 2 or more</b>
<b>Usage of Tools</b>	11% (3/28)	32% (9/28)	11% (3/28)	46% (13/28)
<b>a. Which of these three navigation tools are perceived to be more effective, efficient and preferred in finding information for simple information seeking tasks?</b>				
	<b>Menus</b>	<b>Search</b>	<b>Tag Clouds</b>	
<b>Effective</b>	14% (2/14)	43% (6/14)	43% (6/14)	
<b>Efficient</b>	28.57% (4/14)	28.57% (4/14)	42.86% (6/14)	
<b>Preferred</b>	28.57% (4/14)	42.86% (6/14)	28.57% (4/14)	
<b>Easiest</b>	14.295% (2/14)	50.00% (7/14)	35.71% (5/14)	
<b>b. Which of the two types of tag cloud (single author-driven vs. community of authors-driven) is more efficient and preferred in finding information for simple information seeking tasks?</b>				
<b>Time to Complete</b>	Participants who used single author-driven tag clouds completed the task faster than when they used community of authors-driven tag clouds. However, this difference was not statistically significant (significance level 0.075).			
<b>Number of Clicks</b>	Participants who used single author-driven tag clouds required fewer clicks to complete the task than when they used community of authors-driven tag clouds. This difference was statistically significant at significance level 0.002.			
<b>Preferred</b>	Single author-driven tag clouds were more enjoyable than community of authors-driven tag clouds (64% (9/14) vs. 43% (6/14))			

The research question on how users use website navigation tools for simple information seeking tasks, revealed that more than half of the participants (57%, 8/14), used one navigation tool to complete the task. However, 43% (6/14) used a combination of navigation tools to complete the task. In addition, the qualitative findings prove that more than half the participants (57%, 8/14) indicated they prefer at least two to three

navigation tools on a website. An important guideline is derived from this finding, which is to provide multiple navigation tools within websites (at least two or more).

Qualitative data was used to answer the first part of the research question which was to find which of the three navigation tools are perceived to be more effective, efficient and preferred in finding information for simple information seeking tasks. We found that search and tag clouds were more highly rated than menus. Through the questionnaires and interview sessions it was determined that participants liked how tag clouds allowed them to click on a tag and get to the web page in a single click. They also indicated that they found tags to be confusing and disliked the similarity between the tags and they were not sure what it represented (i.e., why the information appeared in the tag cloud). Based on these findings, the following four guidelines were derived:

- a) identify links to web pages within the target website without the need of explicit labeling (i.e., without the need of tagging);
- b) provide single-click access to web pages within the target website;
- c) provide multiple navigation tools within the target website (at least two or more);  
and
- d) provide a rationale for information that appears in the navigation tool (i.e., what does a tag in a tag cloud represent).

Quantitative data was used to answer the second part of the research question which was to find which of the two types of tag clouds (single author vs. community of authors) is more efficient and preferred in finding information for simple information seeking tasks. Using ANOVA, we found that single author tag clouds required fewer clicks to complete the task than the community of authors tag clouds and this difference was statistically significant at significance level 0.002. In addition, 64% (9/14) of the participants found single author tag clouds to be more enjoyable than community of author tag clouds.

## 4.6 Study Limitations

Although the findings from the preliminary 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.

## 4.7 Conclusion and Motivation for Phase 2

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 as useful as search in finding information. Tag clouds where the tags are created by a single author were more efficient (in terms of number of clicks) than tags created by a community of authors. This is largely due to inconsistency in tagging practices as well as the lack of knowledge on what the tags represent, which caused user frustration in this study. From this study, it was also determined that the type of tasks and the type of websites are important factors to consider as they derive how and which navigation tools users use within websites. The findings showed problems with relying on the community of authors-driven links (shown as tag clouds), for the purposes of improving navigation within the website.

In addition to gaining a better understanding of how users used and perceived the three navigation tools, we gained valuable insights on which factors to consider moving forward in order to improve navigation within websites.

The following four guidelines were derived from the results of this study:

- a) identify links to web pages within the target website without the need of explicit labeling (i.e., without the need of tagging);
  - b) provide single-click access to web pages within the target website;
  - c) provide multiple navigation tools within the target website (at least two or more);
- and

- d) provide a rationale for information that appears in the navigation tool (i.e., what does a tag in a tag cloud represent).

User-generated content on the web is increasing at a rapid rate and in real-time. The need for navigation tools to bring such information forefront when navigating websites is crucial. This study showed that single author-driven tag clouds were more efficient than community of author-driven tag clouds. Given that there is more demand for community's input, and the tagging of content by users poses issues, we decided to examine links to target websites that have been shared on social media. These links are selected and shared by the community of users in real-time. The next phase of the research (Phase 2) examines links available on social media sites pointing users to the target websites.



## Chapter 5 – Phase 2 – Link Analysis, Guidelines and Prototype Implementation

Social media users frequently share links to various web pages on social media sites such as Twitter (Boyd et al., 2010; Hughes and Palen, 2010; Lovejoy et al., 2012; Suster, 2011; White et al., 2013). The findings of Phase 1 led us to explore the potential of using links to websites in social media to help users navigate more quickly to web pages within a target website. In Phase 2, we examine the characteristics of those links and the characteristics of websites that may benefit most from navigation based on user selected links to those target websites (Nizam et al., 2014). We decided to use Twitter data because of its popularity and it being the fastest-growing social media platform in the world, its international reach, and the accessibility of data for the study.

### 5.1 Study Objectives

The purpose of this study was two-fold: to examine links shared on Twitter during popular events in order to better understand the characteristics of these links and to further refine the characteristics of websites which may benefit from navigation based on links shared on social media. We collected and analyzed tweets pertaining to four popular events; two of which were sporting events (London Olympics 2012 and the World Junior Hockey 2013 Tournament) while the remaining two were entertainment events (The Big Bang Theory episodes from December 2012 and January 2013 and 2013 Golden Globe Awards). The dates for these events are presented in Table 5.1.

### 5.2 Research Questions

The following two research questions were part of this study:

**RQ2: What are the characteristics of links shared on social media pertaining to a target website?**

- a. How often do users share links during these four events on social media?
- b. How many of these are unique links from these four target websites?
- c. What are the top 10 links shared from these four target websites?

- d. What is the depth of links from the website's home page for the four target websites?
- e. What is the type of information contained in those links for the four target websites?

**RQ3: What are the characteristics of links shared on social media pertaining to other websites?**

- a. How many links are to other websites and what type of information is contained in those links?
- b. Which types of websites may benefit from a community-driven navigation tool?

## 5.3 Methodology

### 5.3.1 Sampling

In order to examine the characteristics of links shared on social media, and knowing that displaying popular pages based on links shared on social media may not be beneficial for all websites, we focused on a sample of websites related to four different events that met these broad characteristics:

1. A website with high volume of social media traffic on various social networks such as Twitter, Facebook, Google+, and/or Pinterest.
2. A website containing at least 100 pages.
3. An event that is either sports related or entertainment related.
4. An event with a narrow time frame (from one day to two weeks).

Based on the above characteristics, four websites representing four popular sports-related or entertainment-related events were selected, as illustrated in Table 5.1 and Figure 5.1.

Table 5.1 - Four events and their target website URLs

Events	Event Dates	Target Website URL	Total # of Pages
<b>Event Duration: Over a week &amp; Sports</b>			
London Olympics 2012	July 27, 2012 - August 12, 2012	<a href="http://www.london2012.com">www.london2012.com</a>	5350
World Junior Hockey	December 26, 2012 – January 5, 2013	<a href="http://worldjunior2013.com">http://worldjunior2013.com</a>	169
<b>Event Duration: Over a day &amp; Entertainment</b>			
The Big Bang Theory	Dec 6, 2012, Dec 13, 2012, Jan 3, 2013, Jan 10, 2013	<a href="http://www.cbs.com/shows/big_bang_theory/">http://www.cbs.com/shows/big_bang_theory/</a>	1061
Golden Globe Awards	Jan 13, 2013	<a href="http://www.goldenglobes.org/">http://www.goldenglobes.org/</a>	9801



Figure 5.1 – Screenshot of the four target website’s home page

These four events were selected for this study due to their popularity. For instance, the London Olympics 2012 attracted 20 million spectators from around the world over a two week period. In addition, the 37<sup>th</sup> World Junior Ice Hockey Championships (WJHC) was hosted over a 10 day period in Ufa, Russia. It began on December 26, 2012 and ended with the gold medal game on January 5, 2013. Furthermore, the Big Bang Theory is a popular weekly sitcom which airs on CBS television network. It is one of the most popular shows in US, ranking as the #1 sitcom during the 2012/13 season. Likewise, the Golden Globe Awards is an annual ceremony which honors talent in film and television. January 13, 2013 marked the 70th presentation of the Golden Globe Awards. These four recurring-events vary in duration, ranging from two weeks to a day, and were of different periodicity (4 years cycle (Olympics), 1 year cycle (World Junior Hockey, Golden Globe Awards) and weekly cycle (The Big Bang Theory)). These events were chosen to see if there is any correlation between the duration of the event and links shared on social media.

The total number of web pages for each website was determined using a sitemap generator called XML-Sitemaps.com ([www.xml-sitemaps.com/](http://www.xml-sitemaps.com/)). The two websites with the duration of one day (i.e., The Big Bang Theory and Golden Globe Awards) allowed users to post/share content on Twitter from within the website, whereas the other two websites (London Olympics 2012 and World Junior Hockey) lacked this feature at the time of the study.

### **5.3.2 Data Collection**

For the purposes of this study, we selected Twitter as the source of the social media data. Twitter is one of the fastest-growing social media platforms in the world with over 284 million monthly active users (Twitter, 2014). The use of Twitter has evolved into a platform to share and disseminate information (Gupta and Kumaraguru, 2012). Early adopters of Twitter began providing links to outside content by including the URL in their tweets (Boyd et al., 2010). This is useful as the 140 character limit can be restricting for those who want to convey large amount of information. Because URLs are generally

long, people used URL shortener services (e.g., <http://bit.ly>) to abbreviate URLs, which, when clicked, redirected to the desired web page.

Researchers have investigated Twitter from many different angles: from examining properties of tweets (Cheong and Lee, 2009) and tracking the increased use of URLs in tweets (Hullman et al., 2011) to comparing communication patterns on Twitter (Bruns and Liang, 2012; Bruns and Stieglitz, 2012) and developing credibility ranking algorithms for tweets during high impact events (Gupta and Kumaraguru, 2012). White et al. (2013) examined the types of links on Twitter and found that a majority of the #tarsands tweets contained links to articles (29.2%) and websites (22.6%). Similarly, Hughes and Palen (2010) found that 25% tweets normally includes a URL, however it is higher, around 40-50%, during emergencies such as hurricanes as well as mass convergence events. Lovejoy et al. (2012) discovered that a majority of the non-profit tweets (68%) included links to external information. The evidence of link sharing on Twitter is highlighted by these studies while further analysis illustrates the importance of link sharing as an effective marketing strategy for driving traffic to a web page (Suster, 2011; The Next Web, 2013). Our study builds on these findings and focuses on the effects of aggregating links shared on social media by a community of users, as a way of creating opportunities for community-driven navigation systems to emerge.

Using Netlytic, a web based system for automated text analysis and the discovery of social network, we collected a sample of tweets associated to the four events. These tweets were collected over a six month period, from July 2012 to January 2013. At the time of the data collection, Netlytic relied on the public Twitter Search API 1.0. In the next phase of the research, Netlytic relied on Twitter's Streaming API to give a broader coverage of the sample. Table 5.2 presents the duration of data collection along with the hashtags used for the four events. These hashtags were chosen for this study as they were the official hashtags created by the event organizers.

In addition to the actual Twitter message (“tweet”), the resulting datasets included the following metadata: id, tweet URL, publication date, username (author), and source (the device/application used to generate the tweet). URLs from all the tweets were extracted using a PHP (Hypertext Preprocessor) script (see Appendix 5.A). Shortened URLs were un-shortened using the PHP Client URL Library (cURL). The un-shortened URLs were then analyzed using Microsoft Excel.

Table 5.2 – Data collection period and hashtag(s)

Events	Data Collection Period	Hashtag(s)
<i>Event Duration: Over a week</i>		
London Olympics 2012	July 27, 2012 5:24:00 PM – August 5, 2012 5:04:00 PM	#London2012
World Junior Hockey	Dec 7, 2012 10:21:53 AM – January 5, 2013 4:58:30 PM	#WJC2013, #2013WJC, #worldjunior, #worldjunior2013
<i>Event Duration: Over a day</i>		
The Big Bang Theory	Dec 12, 2012 5:10:22 PM – Jan 10, 2013 11:58:33 PM	#BigBangTheory
Golden Globe Awards	Jan 10, 2013 4:21:49 PM – Jan 15, 2013 7:58:46 AM	#GoldenGlobes

## 5.4 Results

A total of 264,647 tweets and re-tweets were collected over the four events. Table 5.3 presents the number of tweets collected, number of tweets containing links, and number of tweets containing links from the target website. Data from London Olympics 2012 showed that 47% of the tweets contained a link, out of which 48% were links to the target website. Between 25-37% of the tweets contained links for the other events, out of which less than 7% were links to the target website.

Table 5.3 – Number of tweets and tweets with links (URLs)

Events	London Olympics 2012	World Junior Hockey	Big Bang Theory	Golden Globe Awards
# of tweets collected	77142	49624	86302	51579
# of tweets containing a link	36279 (47%)	12455 (25%)	24945 (29%)	19109 (37%)
a) # of tweets containing target website links	17257 (48%)	163 (1.3%)	1757 (7%)	80 (0.4%)
b) # of tweets containing external links	19022 (52%)	12292 (98%)	23188 (93%)	19029 (99.6%)

The pattern observed for London Olympics 2012 was notably different from the other events. For instance, analysis revealed the highest number of tweets containing a link, highest number of tweets containing a link to the target website and lowest number of tweets containing links to other websites. These results indicate a noticeable difference, wherein there is a dependence on the target website for the other events. Perhaps the London Olympics 2012 website was the primary source for up-to-date information for this event. Also, the Olympics attract a large community both physically and through an online presence. It is probable that the density of individuals within the geographic location contributed to an increase in tweets, which gave individuals an opportunity to participate and contribute to the event.

#### 5.4.1 Unique Links

Unique links are those that represent distinct web pages within a website. The number of unique links that were shared on Twitter are shown in Table 5.4. Tweets from the sports-related events (London Olympics 2012 and World Junior Hockey) contained the highest percentage of unique links (8% and 19%). This indicated that people shared many unique pages on Twitter for the two sports-related events which meant that more pages within that website contained popular content. It is also interesting to note that not all pages

within the target website got tweeted and that not all websites with large volume of pages would correspond to large number of tweets containing links. Therefore, our initial criterion, that a website must contain at least 100 pages, is not important (at least based on our small sample of the four websites). Instead, we proposed a revision that while websites we observed may be small, they must contain content which has the potential to be popular on social media. These types of websites would likely benefit from the links shared on social media.

Table 5.4 – Unique links shared in tweets and re-tweets

Events	London Olympics 2012	World Junior Hockey	Big Bang Theory	Golden Globe Awards
<b>Total # of target website links</b>	5350	169	1061	9801
<b>Total # of unique website links tweeted</b>	439 (8%)	32 (19%)	16 (1.5%)	14 (0.14%)

#### 5.4.2 Profile of Top 10 Links

All tweets, containing links to the four target websites, were analyzed to determine the top 10 most tweeted links. Table 5.5 presents the top 10 most tweeted links along with the number of times they appeared in tweets. Table 5.6 shows the percentage of tweets which represents the top 10 most tweeted links among all tweets collected. We noticed a difference between the London Olympic 2012 event (the top 10 links make up 22% of all tweets containing links) and the others (the top 10 links make up 71%, 99%, and 95% for World Junior Hockey, Big Bang Theory and Golden Globe Awards tweets respectively). This indicates that the London Olympics 2012 website had a wider distribution among all their pages that got shared (i.e., more unique pages got shared and therefore, the top 10 tweeted links only make up 22% of their total distribution). Therefore, the London Olympics 2012 website contained a wide range of popular pages.



Table 5.5 – Top 10 links with sharing frequency on Twitter

	Website URLs	Number of Occurrences
<b>London Olympics 2012</b>		
1	<a href="http://www.london2012.com/">http://www.london2012.com/</a>	644
2	<a href="http://www.london2012.com/news/articles/lochte-blasts-past-phelps.html">http://www.london2012.com/news/articles/lochte-blasts-past-phelps.html</a>	519
3	<a href="http://www.london2012.com/athletics/event/men-400m/index.html?v=20120804-103226924">http://www.london2012.com/athletics/event/men-400m/index.html?v=20120804-103226924</a>	440
4	<a href="http://www.london2012.com/football/event/men/index.html">http://www.london2012.com/football/event/men/index.html</a>	355
5	<a href="http://www.london2012.com/schedule-and-results/">http://www.london2012.com/schedule-and-results/</a>	349
6	<a href="http://www.london2012.com/athletes/birthdays/index.html">http://www.london2012.com/athletes/birthdays/index.html</a>	339
7	<a href="http://www.london2012.com/cycling-track/event/men-team-sprint/index.html?v=20120802-185053806">http://www.london2012.com/cycling-track/event/men-team-sprint/index.html?v=20120802-185053806</a>	299
8	<a href="http://www.london2012.com/swimming/">http://www.london2012.com/swimming/</a>	296
9	<a href="http://www.london2012.com/rowing/event/women-pair/phase=row021100/index.html?v=2012-08-01115503Z">http://www.london2012.com/rowing/event/women-pair/phase=row021100/index.html?v=2012-08-01115503Z</a>	295
10	<a href="http://www.london2012.com/athletics/">http://www.london2012.com/athletics/</a>	292
<b>World Junior Hockey 2013</b>		
1	<a href="http://www.worldjunior2013.com/en/channels/2013/wm20/top/news/cze-usa-14/">http://www.worldjunior2013.com/en/channels/2013/wm20/top/news/cze-usa-14/</a>	22
2	<a href="http://www.worldjunior2013.com/en/channels/2013/wm20/top/news/ger-lat/">http://www.worldjunior2013.com/en/channels/2013/wm20/top/news/ger-lat/</a>	19
3	<a href="http://www.worldjunior2013.com">http://www.worldjunior2013.com</a>	11
4	<a href="http://www.worldjunior2013.com/en/channels/2013/wm20/top/news/5th-6th/">http://www.worldjunior2013.com/en/channels/2013/wm20/top/news/5th-6th/</a>	11
5	<a href="http://www.worldjunior2013.com/en/channels/2013/wm20/top/news/fin-ger-rele/">http://www.worldjunior2013.com/en/channels/2013/wm20/top/news/fin-ger-rele/</a>	11
6	<a href="http://www.worldjunior2013.com/en/channels/2013/wm20/top/news/finns-pound-slovaks/">http://www.worldjunior2013.com/en/channels/2013/wm20/top/news/finns-pound-slovaks/</a>	11
7	<a href="http://www.worldjunior2013.com/en/channels/2013/wm20/top/news/bronze/">http://www.worldjunior2013.com/en/channels/2013/wm20/top/news/bronze/</a>	9
8	<a href="http://www.worldjunior2013.com/en/channels/2013/wm20/top/news/swe-preview/">http://www.worldjunior2013.com/en/channels/2013/wm20/top/news/swe-preview/</a>	8
9	<a href="http://www.worldjunior2013.com/en/channels/2013/wm20/top/news/where-does-canada-go-now/">http://www.worldjunior2013.com/en/channels/2013/wm20/top/news/where-does-canada-go-now/</a>	8
10	<a href="http://www.worldjunior2013.com/en/channels/2013/wm20/top/news/ufa-best-ever/">http://www.worldjunior2013.com/en/channels/2013/wm20/top/news/ufa-best-ever/</a>	6
<b>Big Bang Theory</b>		
1	<a href="http://www.cbs.com/shows/big_bang_theory/video/">http://www.cbs.com/shows/big_bang_theory/video/</a>	630
2	<a href="http://www.cbs.com/shows/big_bang_theory/photos/191123/golden-globe-nominations">http://www.cbs.com/shows/big_bang_theory/photos/191123/golden-globe-nominations</a>	480
3	<a href="http://www.cbs.com/shows/big_bang_theory/photos/192941/season-6-episode-4">http://www.cbs.com/shows/big_bang_theory/photos/192941/season-6-episode-4</a>	347
4	<a href="http://www.cbs.com/shows/big_bang_theory/photos/1000046/season-6-episode-12/33417">http://www.cbs.com/shows/big_bang_theory/photos/1000046/season-6-episode-12/33417</a>	142
5	<a href="http://www.cbs.com/shows/big_bang_theory/photos/111112/season-5-episode-24/10123">http://www.cbs.com/shows/big_bang_theory/photos/111112/season-5-episode-24/10123</a>	59
6	<a href="http://www.cbs.com/shows/big_bang_theory/video/D6582F3E-6F5A-07DF-41B1-91B9E9C3CE62/the-big-bang-theory-sexy-nerdy-ladies">http://www.cbs.com/shows/big_bang_theory/video/D6582F3E-6F5A-07DF-41B1-91B9E9C3CE62/the-big-bang-theory-sexy-nerdy-ladies</a>	43
7	<a href="http://www.cbs.com/shows/big_bang_theory/photos/192104/season-6-episode-3/14833">http://www.cbs.com/shows/big_bang_theory/photos/192104/season-6-episode-3/14833</a>	20
8	<a href="http://www.cbs.com/shows/big_bang_theory/video/5AA75DBE-20FB-DE93-A0C7-028C7D386593/the-big-bang-theory-the-egg-salad-equivalency">http://www.cbs.com/shows/big_bang_theory/video/5AA75DBE-20FB-DE93-A0C7-028C7D386593/the-big-bang-theory-the-egg-salad-equivalency</a>	20
9	<a href="http://www.cbs.com/shows/big_bang_theory/photos/193661/season-6-episode-5/193668">http://www.cbs.com/shows/big_bang_theory/photos/193661/season-6-episode-5/193668</a>	6
10	<a href="http://www.cbs.com/shows/big_bang_theory/video/31059D97-FE03-66D5-EA78-048635195235/the-big-bang-theory-flash-mob-">http://www.cbs.com/shows/big_bang_theory/video/31059D97-FE03-66D5-EA78-048635195235/the-big-bang-theory-flash-mob-</a>	3
<b>Golden Globe Awards 2013</b>		
1	<a href="http://www.goldenglobes.org/2012/12/nominations-2013/">http://www.goldenglobes.org/2012/12/nominations-2013/</a>	31
2	<a href="http://www.goldenglobes.org/photo-gallery-2013/">http://www.goldenglobes.org/photo-gallery-2013/</a>	20
3	<a href="http://www.goldenglobes.org/2013/01/globes-fashion-on-the-red-carpet/">http://www.goldenglobes.org/2013/01/globes-fashion-on-the-red-carpet/</a>	10
4	<a href="http://www.goldenglobes.org/history/">http://www.goldenglobes.org/history/</a>	4
5	<a href="http://www.goldenglobes.org/">http://www.goldenglobes.org/</a>	3
6	<a href="http://www.goldenglobes.org/symposium2013-1/">http://www.goldenglobes.org/symposium2013-1/</a>	3
7	<a href="http://www.goldenglobes.org/2013/01/for-globes-night-a-menu-fit-for-stars/">http://www.goldenglobes.org/2013/01/for-globes-night-a-menu-fit-for-stars/</a>	2
8	<a href="http://www.goldenglobes.org/2012/01/the-keepers-of-the-secret/">http://www.goldenglobes.org/2012/01/the-keepers-of-the-secret/</a>	1
9	<a href="http://www.goldenglobes.org/2012/11/jodie-foster-is-psyched-to-receive-the-cecil-b-de-mille-award/">http://www.goldenglobes.org/2012/11/jodie-foster-is-psyched-to-receive-the-cecil-b-de-mille-award/</a>	1
10	<a href="http://www.goldenglobes.org/2012/12/tina-fey-and-amy-poehler-are-ready-for-the-70th-golden-globe-awards/">http://www.goldenglobes.org/2012/12/tina-fey-and-amy-poehler-are-ready-for-the-70th-golden-globe-awards/</a>	1

Table 5.6 – Distribution of top 10 links among all tweets containing links

<b>Events</b>	<b>London Olympics 2012</b>	<b>World Junior Hockey</b>	<b>Big Bang Theory</b>	<b>Golden Globe Awards</b>
<b># tweets containing target website links</b>	17257	163	1757	80
<b># of total tweets for top 10 links</b>	3828 (22%)	116 (71%)	1750 (99%)	76 (95%)

These findings are important as we now know that showing just the top 10 popular pages would only represent a subset of popular pages and therefore, we would need to offer website visitors the ability to view more than just the top 10 popular pages. Therefore, we decided to extract and display top 20 popular pages, in the order of most popular to least popular, in our prototype design (see section 5.8).

#### 5.4.3 Depth of Links from the Website’s Home Page

The number of clicks required from the home page to the linked web page was determined manually for all links. Over 80% of the links were accessible within 1-2 clicks from the home page of World Junior Hockey, Big Bang Theory and Golden Globe Awards websites. For London Olympics 2012 website, 70% of links were 3-4 clicks away from the home page and 8% were 5 clicks away from the home page, as shown in Figure 5.2. This demonstrated that users do share pages on social media that are located deep within the website (i.e., requiring multiple clicks to get to from the website’s home page) allowing others to view these pages through social media with just a click. Therefore, bringing these pages to the home page would allow quick access to content, in the case where users do not use social media sites but are visitors of the website. This observation contributes directly to our website selection criteria as it indicates that the new navigation mechanism, which would provide access to popular pages through one click, would potentially benefit those websites that contain popular pages requiring two or more clicks from the home page.

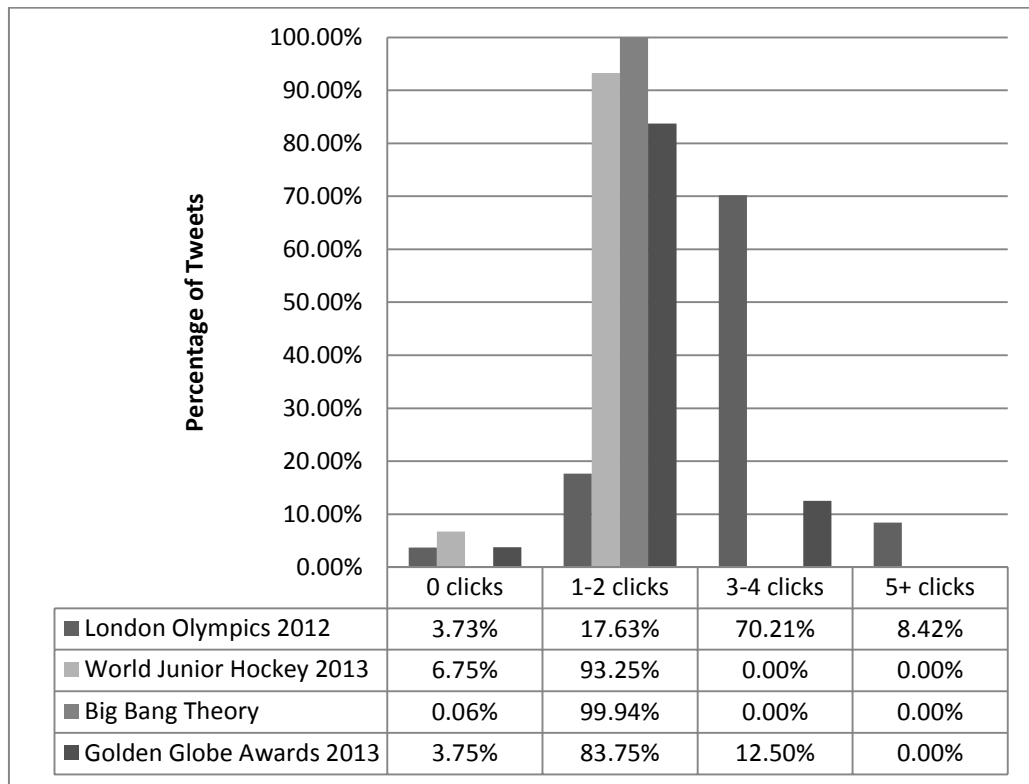


Figure 5.2 – Depth of links from the target website’s home page

#### 5.4.4 Types of Links

All tweets containing links to the target websites were manually analyzed to determine the type of web content and information they provided. These were then divided into five different categories: home page, articles (news stories), photos, videos and schedules/scores. Users mostly shared links containing news stories during the three events (London Olympics 2012: 28%, World Junior Hockey: 93% and Golden Globe Awards: 14%), as shown in Figure 5.3. Links pointing to schedules/scores was noticeable for London Olympics 2012 (59%) and Golden Globe Awards (39%) only. Links pointing to photos (Big Bang Theory: 60% and Golden Globe Awards: 25%) and videos (Big Bang Theory: 40% and Golden Globe Awards: 19%) were mostly used during entertainment-related events, as shown in Figure 5.3. Few links pointed others to the home page (London Olympics 2012: 4%, World Junior Hockey: 7% and Golden Globe Awards: 4%) which means that users on social media sites are interested in pointing

others directly to the web page containing the relevant information, rather than the home page. The results highlight that, in many cases, sites with frequently updated pages, especially those containing news stories as well as photos and videos, would most likely benefit from a community-driven navigation tool.

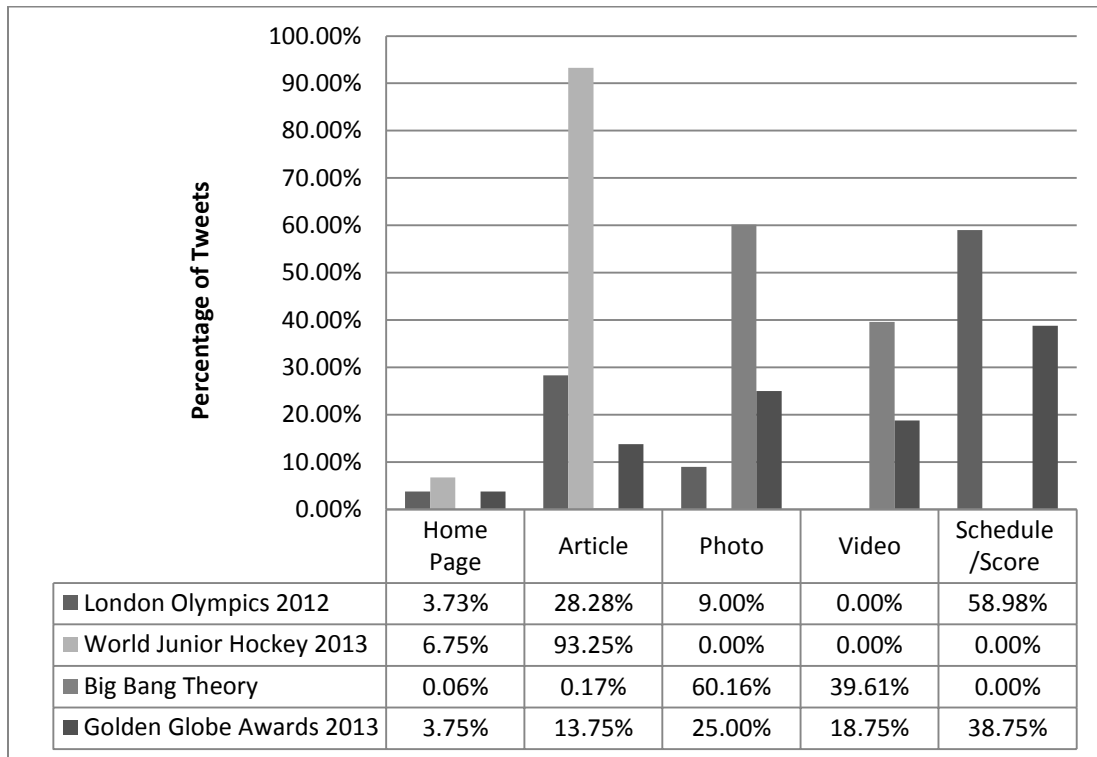


Figure 5.3 – The types of web content referred to in links

#### 5.4.5 Tweets Containing Links to External Websites

A number of tweets contained links which did not link to target websites, as shown in Table 5.7. We wanted to investigate these links, in particular the top 10 most tweeted links, as it may guide future improvements to improve navigation on websites. For the two sports-related events (London Olympics 2012 and World Junior Hockey), the top 10 most tweeted links represents 22% and 43% of all tweets containing links to other web pages (i.e., not target web pages). This indicates that the majority of tweets containing links to other websites were represented among the top 10 most tweeted links for these two events. This was in contrast to the two entertainment-related events (Big Bang Theory and Golden Globe Awards), wherein the top 10 most tweeted links

represented only 9% and 10% of all tweets containing links to other pages. This indicated that the other links for these two events were more scattered and that users shared links to various unique web pages. In the future, if we consider displaying popular pages that are not part of the website (i.e., external web pages), the algorithm needs to be robust enough to handle a large volume of unique web pages.

Table 5.7 – Total tweets containing links to external websites

Events	London Olympics 2012	World Junior Hockey	Big Bang Theory	Golden Globe Awards
<b># of tweets containing other links</b>	19022	12292	23188	19029
<b># of total tweets to top 10 links</b>	4148 (22%)	5323 (43%)	2126 (9%)	1833 (10%)

Furthermore, we analyzed the type of web content shared on the top 10 most tweeted links, especially considering the large representation of links to other web pages during London Olympics 2012 and Golden Globe Awards. We manually analyzed the links and placed them into four categories: articles, photos, videos and spam (i.e., unrelated information). Tweets containing links to photos were common among all four events (London Olympics 2012: 22%, World Junior Hockey: 12%, Big Bang Theory: 4% and Golden Globe Awards: 5%), as shown in Figure 5.4. Tweets containing links to articles were common among the three events (World Junior Hockey: 3%, Big Bang Theory: 3% and Golden Globe Awards: 4%). Tweets containing links to spam was found mostly during World Junior Hockey (28%). Tweets containing links to videos were found only for Big Bang Theory (3%).

As expected, people shared photos during all four events. It is also interesting to note that during World Junior Hockey, 28% of tweets redirected to pages that were not relevant (i.e., spam). Therefore, if in the future we consider displaying popular pages that are not part of the website (i.e., external pages) then our algorithm needs to be robust enough to detect spam and not display those pages to the website visitors.

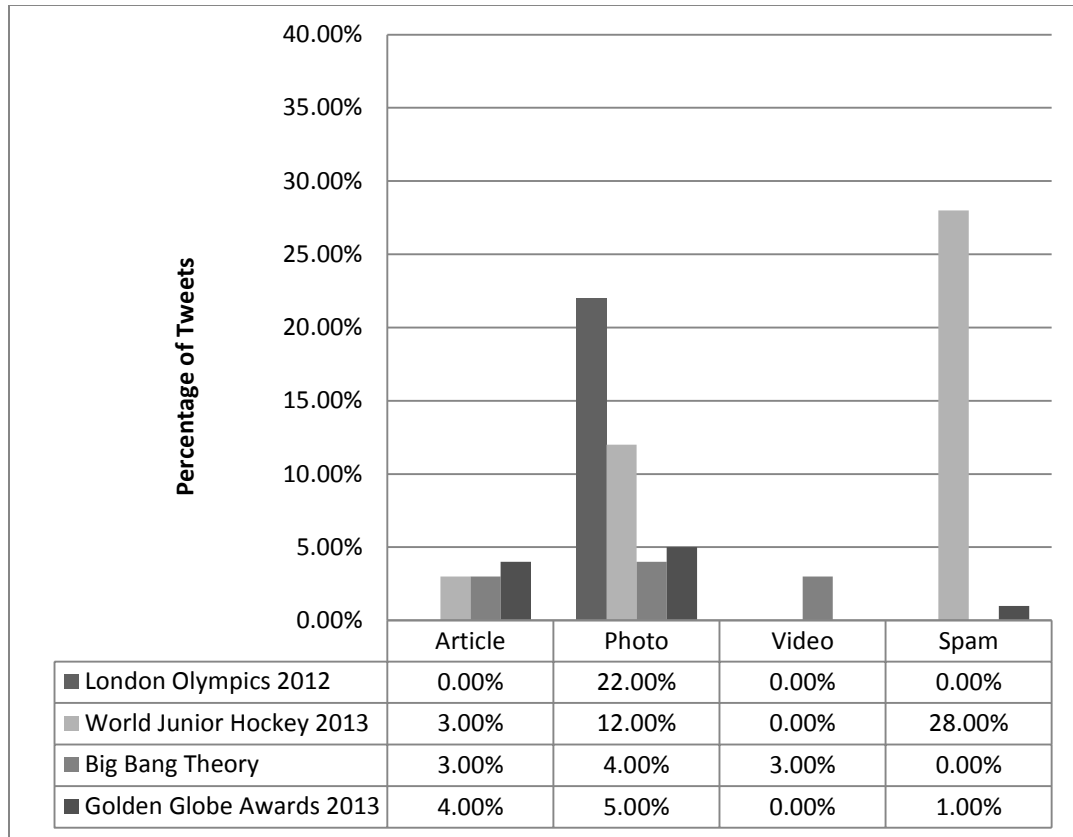


Figure 5.4 – Types of web content on top 10 links to external websites

A similarity between the type of web content shared on links to the target website (section 5.4.4) and the type of web content shared on links to external websites, is that they all point users to either articles, videos or photos. Users shared links to articles that were on the target website more than on external web pages. Perhaps users share articles from the target website as they find it more credible than articles from other websites during events.

## 5.5 Study Implications and Characteristics of Websites

This study examined the characteristics of links shared on Twitter during four events. Between 25-47% of tweets contained links. This indicated that there is enough social media data to implement a prototype and test whether and how social media data can be used to recommend relevant and popular web pages to website visitors.

The findings reveal the characteristics of links shared on social media during these four events. Tweets from the sports-related events (London Olympics 2012 and World Junior Hockey) contained the highest percentage of unique links (8% and 19%). The top 10 links for London Olympics 2012 only made up 22% of all tweets indicating there was a wider distribution of popular pages which got shared, whereas, the top 10 links for the other three events made up majority of their popular pages (71%–99%). Over 80% of the links were accessible within 1-2 clicks from the home page of World Junior Hockey, Big Bang Theory and Golden Globe Awards websites, whereas, 70% of links were 3-4 clicks away from the home page for London Olympics 2012. Users mostly shared links containing articles, schedules/scores for sport-related events (London Olympics 2012 (59%) and Golden Globe Awards (39%)) and shared photos and videos for entertainment-related events (Big Bang Theory (60%, 40%) and Golden Globe Awards (25%, 19%)). Among the tweets containing links to external websites we analyzed the top 10 most tweeted links and found that it represented 22%-43% of all tweets for the two sports-related events and 9%-10% of all tweets for the two entertainment-related events. Most of the external links directed users to photos and articles and some to spam and videos.

The differences observed when analyzing London Olympics 2012 data was interesting as it contained tweets with the highest number of links (47%), tweets with the highest number of links to the target website (48%) and tweets with a high number of unique links to the target website (8%). This demonstrated that the type of the event and the characteristics of the website are important factors to consider when implementing a community-driven navigation mechanism within websites. This study helped us refine the characteristics of websites that could benefit from the links that are shared in social media. These characteristics are as follows:

1. Websites featuring content that has the potential to be popular on social media sites, such as Twitter.
2. Websites with popular pages requiring two or more clicks from the home page.

3. Websites that are updated on a regular basis and contains content, such as articles, schedule/ scores, photos and videos.
4. Websites with social media plugins allowing users to post messages to social media from within the website.

## **5.6 Study Limitations**

Four events and their websites were considered for this study. This was not representative of all websites and events on the Web. Furthermore, we used the Twitter Search API to collect the sample. In the next phase of our research (Phase 3), we used the Twitter Streaming API to capture a broader sample of twitter messages.

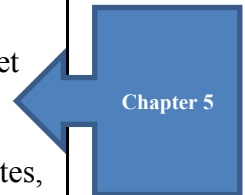
## **5.7 Guidelines for an Improved Navigation Tool**

The first phase of the research provided four guidelines which focused mainly on the design aspects of the navigation tool, whereas the second phase of the research allowed us to add to these guidelines based on the characteristics of links shared on social media sites. Based on the findings of this study, for all three websites with the exception of London Olympics, the top 10 pages made up majority of the web pages that were shared on social media. However, for London Olympics, the top 10 pages only made up 22% of the web pages. Therefore, it was deemed necessary to include another 10 in order to capture both small and large websites. The displaying of the web pages from most popular to least popular was derived based on the findings of this study as well as the findings of the preliminary study where we investigated tag clouds. The sheer nature of tag clouds which displayed information based on popularity was deemed important by the participants. In addition, similar practice is followed by search engine algorithms as they display the most ranked page first and so on. Another finding of this study revealed that there is a potential of links that are spam (i.e., unrelated content). Therefore, it is crucial to account for these in the new navigation tool. Table 5.8 shows the guidelines from Phase 1 along with the three additional guidelines derived from this study.



Table 5.8 – Guidelines from Phase 1 and Phase 2

Phases	Guidelines
<b>Phase 1: Preliminary Study</b>	<ul style="list-style-type: none"> <li>a) Identify links to web pages within the target website without the need of explicit labeling (i.e., without the need of tagging);</li> <li>b) Provide single-click access to web pages within the target website;</li> <li>c) Provide multiple navigation tools within the target website (at least two or more); and</li> <li>d) Provide a rationale for information that appears in the navigation tool (i.e., what does a tag in a tag cloud represent).</li> </ul>
<b>Phase 2: Link Analysis Study</b>	<ul style="list-style-type: none"> <li>e) Display between 10 to 20 unique links to web pages within the target website.</li> <li>f) Display in the order of most popular to least popular web pages within the target website.</li> <li>g) Exclude links that are to external websites, including spam.</li> </ul>



## 5.8 Social Media Panel (SMP) Prototype Implementation

### 5.8.1 Design Features linked with Guidelines

The guidelines developed from the preliminary study (Phase 1) and the link analysis study (Phase 2), were used to design and implement a prototype which aggregated and visually presented the link sharing data from social media sites onto websites, which is referred to in this research as the Social Media Panel (SMP). We ultimately envision SMP to be a browser plug-in so that it can be applied to any website.

## **Guidelines from Phase 1**

***a) Identify links to web pages within the target website without the need of explicit labeling (i.e., without the need of tagging);***

In order to represent web page links, we used the actual web page images and displayed it as web page thumbnails, which eliminates the need to tag web pages, as shown in Figure 5.5 (a). This practice has been observed in some browsers, including Google Chrome, which displays the most visited pages as web page thumbnails.

***b) Provide single click access to web pages within the target website.***

The web pages inside the SMP allowed users to click on the web page thumbnail and once clicked, it opened up the clicked web page on the left side of the screen (i.e., left of the SMP), allowing a single click access to the popular web page. This is illustrated in Figure 5.5 (b).

***c) Provide multiple navigation tools within the target website (at least two or more).***

The SMP is envisioned to be an alternate mechanism for finding information within websites and therefore, it was designed to not obstruct current navigation tools within websites, such as menus and search. It was implemented to be displayed vertically on the right side of the web page, as shown in Figure 5.5 (c). This was mainly inspired by the current practices on the web which displays similar type of information within websites. For example, CNN ([www.cnn.com](http://www.cnn.com)) and Huffington Post ([www.huffingtonpost.com](http://www.huffingtonpost.com)) contains a popular information section which is displayed on the right side of their web page in a vertical fashion.

***d) Provide a rationale for information that appears in the navigation tool (i.e., what does a tag in a tag cloud represent).***

In order to inform website visitors of why the web page appeared in SMP, we used two techniques: 1) we displayed the social media icon indicating where the data is being aggregated from; and 2) we displayed the number below the social media icon

representing the number of times the web page has been shared on the social media site, as shown in Figure 5.5 (d, e).

### **Guidelines from Phase 2**

- e) Display between 10 to 20 unique links to web pages within the target website.*

The SMP prototype included 20 web pages and a scroll bar to browse through these pages, as shown in Figure 5.5 (f) and Appendix 6.C.

- f) Display in the order of most popular to least popular web pages within the target website.*

The SMP prototype displayed web pages in the order of most shared to least shared, as shown in Figure 5.5 (g).

- g) Exclude links that are to external websites, including spam.*

The SMP prototype excluded all links to external websites, including spam.

Table 5.9 illustrates the linkage between the guidelines and the features incorporated into the design and implementation of the Social Media Panel (SMP) prototype. Figure 5.5 shows the SMP and its features.

### **5.8.2 Design Platform**

We used Axure RP Pro 6.5, an interactive wireframe software and mockup tool, to develop the SMP prototype. The prototype was built for the London Olympics website and the Sochi 2014 website as described in the next chapter.

Table 5.9 – Guidelines and features implemented in SMP prototype

Phases	Guidelines	Feature Display
<b>Phase 1: Preliminary Study</b>	a) Identify links to web pages within the target website without the need of explicit labeling (i.e., without the need of tagging);	Figure 5.5 (a)
	b) Provide single-click access to web pages within the target website;	Figure 5.5 (b)
	c) Provide multiple navigation tools within the target website (at least two or more); and	Figure 5.5 (c)
	d) Provide a rationale for information that appears in the navigation tool (i.e., what does a tag in a tag cloud represent).	Figure 5.5 (d, e)
<b>Phase 2: Link Analysis Study</b>	e) Display between 10 to 20 unique links to web pages within the target website.	Figure 5.5 (f), Appendix 6.C
	f) Display in the order of most popular to least popular web pages within the target website.	Figure 5.5 (g)
	g) Exclude links that are to external websites, including spam.	N/A



Figure 5.5 – SMP design and features

## 5.9 Conclusion and Motivation for Phase 3

We collected data from Twitter during four different events and analyzed only those tweets containing links. The results from this study provided us with a better understanding of links that were shared during the four events, in particular unique links, top 10 links, depth of links from the website's home page, type of content shared and links to other web pages. The findings from this study and the preliminary study, as described in Chapter 4, helped develop characteristics of websites and guidelines to use when implementing a navigation tool within websites. We used these guidelines to design the features of the Social Media Panel (SMP) and implemented an SMP prototype using Axure.

In Chapter 6, we outline our final study consisting of a focus group and a controlled user study, where we compared SMP with current navigation tools within websites. We further examined the types of tasks (fact finding and browsing) where SMP would be most effective and efficient.

## **Chapter 6 – Phase 3 – Final Study**

In this chapter, we describe our final study consisting of a focus group and a controlled user study. We used the results from the focus group to refine the SMP prototype and we followed this by a user study to determine whether SMP is effective, efficient and engaging for fact finding and browsing tasks. An approval from the Dalhousie University Social Sciences and Humanities Research Ethics Board was acquired before commencing both the focus group and the user study (see Appendix 6.A).

### **6.1 Focus Group**

#### **6.1.1 Study Objectives**

The objective of the focus group was two-fold:

1. To solicit feedback on the SMP prototype and refine the prototype before conducting the user study;
2. To further solicit feedback on the types of websites and tasks to use for the user study.

#### **6.1.2 SMP Prototype for London Olympics 2012**

In Phase 2 of our research, we learned that 47% of the tweets shared during London Olympics 2012 (between July 27, 2012 and August 12, 2012) contained links and 48% of these were links to the official website. Considering the amount of data already collected (77,142 tweets) and the popularity of the event, we decided to use this data and configured the SMP prototype for the London Olympics 2012 website, as illustrated in Figure 6.1.

The first iteration of the SMP prototype, which was used in the focus groups as a proof of concept, had the following four limitations:

1. Only the top three web pages were displayed.
2. The scroll bar was static (i.e., users were unable to use the scrollbar to scroll up or down).

3. The web pages from the London Olympics website, which appeared on the left, were static images. Therefore, the user was unable to click on any of the navigation mechanisms offered by the London Olympics website (i.e., menu, search, links within the content of the web page, etc.).
4. Multiple social media icons were shown in SMP (i.e., Facebook, Google+), however, only data from Twitter was used to determine the popularity of the web page.



Figure 6.1 – London Olympics 2012 website with the SMP prototype

Our user study, described in the section 6.3, addresses these limitations along with additional features developed based on the feedback received from the focus groups.

### 6.1.3 Study Design

Once the SMP prototype was configured for London Olympics 2012, we conducted two focus group sessions in November, 2013. The focus groups were held in the Computer Science building at Dalhousie University in a teaching lab, as shown in Figure 6.2. The lab consisted of desktop computers and allowed for both small and large group discussions to occur. The discussions were videotaped. Each focus group session was an hour long.

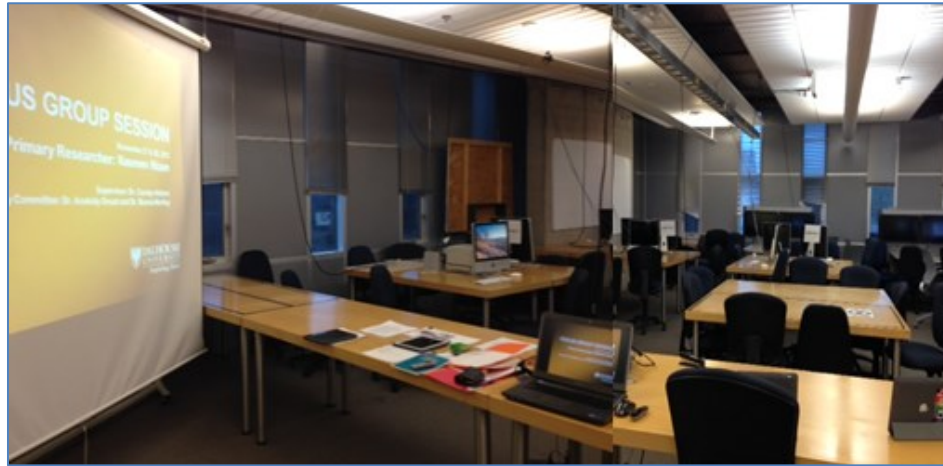


Figure 6.2 – Teaching Lab in Dalhousie Computer Science Building

We recruited Dalhousie University students by sending an email to the Computer Science email distribution list. Participants were scheduled for either of the two sessions on a first-come-first-serve basis. In order to maximize the time spent discussing the SMP during the focus group session, participants were asked to give consent, agree for the discussions to be videotaped and complete an online questionnaire prior to arriving at the session. The online questionnaire consisted of demographic questions and previous experience using social media sites. We used Opinio, an online survey software, to collect participants' responses. During the focus group sessions, we provided participants with an overview of the research and trained them on how to use the SMP prototype. Each of the focus group sessions was divided into three steps, as illustrated in Figure 6.3.



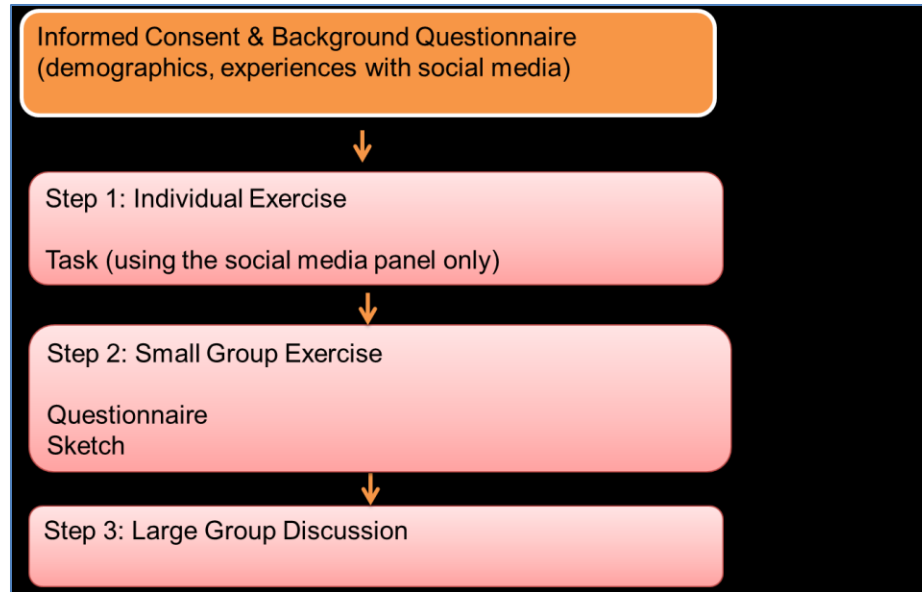


Figure 6.3 – Study design of the focus group sessions

### **Step 1: Individual Exercise (5 minutes)**

Participants were asked to complete a browsing and a fact finding task using the SMP prototype. These tasks were a) find an interesting page (content) that you would like to share with the larger group; and b) who won the men's 400 meter running race?

### **Step 2: Small Group Exercise (20 minutes)**

Participants were asked to form small groups consisting of 2 to 3 participants per group. A total of 7 groups were formed over the two sessions. They were then asked to complete a questionnaire on what they liked and disliked about the SMP and what types of websites and tasks they perceive it being useful for. They were also asked to sketch their ideas on how to improve the SMP prototype.

### **Step 3: Large Group Discussion (30 minutes)**

Participants were brought together to discuss the SMP in a large group setting. A series of questions were used to solicit their feedback on the SMP prototype.

All participants were compensated \$20 for participating in the focus group sessions.

#### 6.1.4 Results

Fifteen Computer Science and Health Informatics students from Dalhousie University (12 males and 3 females) participated in the two focus group sessions. Graduate students accounted for 73% (11/15) of the participants and 60% (9/15) of the participants were between the ages of 18-25. From the background questionnaire, we gathered that the three most used social media applications among the participants were: YouTube (93%: 14/15), Facebook (80%: 12/15), and Instant Messaging (67%: 10/15). All participants indicated that they use laptop and mobile devices to access social media applications. Participants were asked to select the frequency of how often they contribute on social media (i.e., share/post pictures, videos, links etc.) and how often they are the consumers of such information (i.e., follow/click on links, read comments, etc.). A total of 47% (7/15) of the participants shared links (URLs) frequently and 67% (10/15) followed links (URLs) frequently on social media sites. Furthermore, Facebook, YouTube, Instant Messaging and Twitter were the most commonly used social media applications for sharing and following links. All participants indicated that they browse their favorite websites a few times a week or more and news and technology were the top two kind of websites of interest for browsing related tasks. All questions and materials used in the focus groups are illustrated in Appendix 6.B.

#### **Small Group Exercise – Questionnaire and Sketches**

Data from the 7 groups were collected and analyzed. The groups were asked to complete a questionnaire indicating what they liked and disliked about the SMP prototype and what types of websites and tasks would benefit from such a tool. A total of 71% (5/7) liked the SMP prototype because they thought it was consistent, simple, easy to use, allowed for quick access to popular content within the website, and displayed popularity of web pages from multiple social media applications (i.e., Twitter, Facebook and Google+). Only 29% (2/7) indicated that they found the design to be cluttered and that it took real-estate on a screen. They also indicated that it was missing sufficient information regarding the web page (i.e., a title) and that it was hard to read the web page content from the thumbnail. A total of 71% (5/7) indicated that they did not know what the

number underneath the social media icon meant, whether it meant the number of likes or the number of shares (i.e., the sharing of links to web pages in social media). Participants considered it to be useful for websites such as news, events (election, sport results), blogs, and entertainment and shopping. The following illustrates a response to the question *“Do you think there is value in knowing what are the popular pages on a website based on links shared on social media?”*:

*“Absolutely, I would like to know what my friends are seeing...it cuts the noise. If many people are looking at a page, then it must be interesting.” [P009]*

Almost all perceive the panel to be more useful for browsing tasks than fact finding tasks. Each group also sketched improvements to the SMP prototype. Some of these sketches are illustrated in Figure 6.4 and all of the sketches are shown in Appendix 6.C.

What would you add/change? (sketch your ideas) Group ID: 1

Can we have first Back & Forward buttons to navigate Title

If we could have a option to minimize this panel if we no likes etc.

More precise images of the content / reflect the title - not just the screenshot of the entire website.

When mouse-over, may see if we could zoom-in and find more information about link.

→ May be we should categorize the likes / tweets into categories like Individual Events, Group Events etc.

→ Option to like / Retweet or share the visited Page.

What would you add/change? (sketch your ideas) Group ID: 6

Add titles for the pages

Real time update for the ranking number

Real time update of the pages content

What would you add/change? (sketch your ideas) Group ID: 4

Info on cover

categories for different sub-j of

Move info

Who Posts what.

Time info.

Location

organization options

info on cover

categories for different sub-j of

Move info

Who Posts what.

Time info.

Location

organization options

Figure 6.4 – Sketches illustrating suggested design improvements to SMP

Participants' suggestions, gathered from the sketches, were reviewed to check for similarities and themes. Any similar suggestions were grouped and treated as one suggestion. Using Microsoft Excel, all suggestions were transcribed and coded into the following three main categories and sub-topics:

**1. Design (i.e., look and feel of SMP)**

- a. Display the title of the web page, since the size of the web page thumbnail is small and is not readable.
- b. Display a zoomed version of the web page when the user hovers over the thumbnail so that the content of the web page is readable.
- c. Display what the number/count represents.

**2. Functionality (i.e., information inside SMP)**

- a. Display the number/count next to the social media icon in real-time.
- b. If content on a web page changes frequently, display the updated version of the web page thumbnail in real-time.
- c. If a web page is popular on multiple social media applications, display the information from these multiple social media applications, including the number/count.
- d. Display additional information, such as who shared/followed the web page (i.e., friends from their social media network) and the geographic location of the users sharing such information.
- e. Provide the ability to share/post the web page from SMP to social media sites.
- f. Provide the ability to filter on the types of web pages to display inside the SMP, such as web pages that are liked or shared, web pages from a particular social media application, or web pages that are popular among their friend's network on Twitter.
- g. Provide the ability to search within the SMP (i.e., keyword search) so that only popular pages based on the keyword(s) are shown in SMP.

### **3. Placement (i.e., location of SMP)**

- a. Enable SMP to slide in and out so that it does not always require real-estate when viewing content on a web page.
- b. Enable SMP to be flexible so that one can place it horizontally or vertically anywhere on the web page.

### **Large Group Discussions**

The large group discussions were meant to probe what participants liked and disliked about the SMP in order to devise improvements for the next phase of the research. Hand written notes and video recordings were analyzed to detect themes and feedback. Common themes emerged and have been described in section 6.2. In addition, the discussions suggested future research work. Since almost all participants used mobile devices to access social media sites, they were interested in how SMP would function on small screen devices. They suggested adding functionality to display the context around the popular web pages (i.e., whether they are shared in a positive context or a negative context). Our research focuses on displaying popular pages based on pages internal to the website. Participants indicated that there may be value in displaying popular and relevant web pages that are external to the website. They also suggested that this tool could help with information re-visitation on a website. Participants expressed concerns around popular pages remaining popular and pages of interest may never make it to the top. They also indicated that they prefer the SMP to be simple and that it should not consume unnecessary bandwidth which may compromise the browsing experience on a website using a mobile device, in particular.

The session concluded with a final question on whether they thought there was value in knowing the popular pages on a website based on pages shared on social media sites. A number of participants indicated that there is value in knowing this information and that it provides quick access to popular web pages within the website:

*“I think it would be a great addition to almost any website... There is absolutely value in, like so much value in knowing what is the most popular thing on the website the second you visit it. That’s just, that’s huge really.” [P010]*

*“It depends on an individual I guess, how he perceives and use. Sometimes you are looking for who has shared the news rather than the number of people who has shared the news.” [P003]*

*“When you have this kind of website, it’s showing you very big picture whatever the authors of the website chose is most popular topic versus in this way you see what people think is most popular and important, on the same website, and that’s what I liked”. [P017]*

### **6.1.5 Study Limitations**

Although the findings from this study provide rich qualitative information for the design of the SMP, it is important to note the limitation of this study. The focus group participants were all from the field of either Computer Science or Health Informatics with a technical background. Therefore, these participants were advanced users of the web and not representative of other users on the web.

### **6.1.6 Summary**

We solicited feedback through two focus group sessions. Several design and functionality enhancements to the SMP were recommended by the participants through discussions and sketches. In addition, participants indicated that they perceived SMP to be more useful for browsing a website rather than finding specific information on a website. They also perceived SMP being useful on news, sporting events, blogs and ecommerce websites. In the next section, we describe the refinement of the SMP prototype in preparation of the user study.

## **6.2 Social Media Panel (SMP) Prototype Refinement**

In order to minimize the limitations of SMP, as presented in section 6.1.1, we refined the SMP prototype and incorporated some of the recommendations received from the focus groups. We describe the second iteration, a refinement, of the SMP prototype in this section and configure it for both the London Olympics 2012 website and the Sochi 2014

website in preparation for our next user study. Details on why these websites were selected are described in the next section. We first addressed the limitations of the first iteration as illustrated in Table 6.1.

Table 6.1 - Refined SMP prototype based on limitations

Limitations	SMP Prototype (second iteration)
1. Only the top three web pages were displayed	1. Included the top 20 most shared web pages in the SMP prototype.
2. The scroll bar was static (i.e., users were unable to use the scrollbar to scroll up or down).	2. Added a dynamic scroll bar, which allowed users to scroll up and down the SMP prototype.
3. The web pages, which appeared on the left, were static images. Therefore, the user was unable to click on any of the navigation mechanisms (i.e., menu, search, links within the content of the web page, etc.).	3. All web pages appearing on the left, were dynamic, allowing users to navigate the website using other navigation mechanisms on the web page (i.e., menu, search, links within the content of the web page, etc.). We used iFrames to implement this change.
4. Multiple social media icons were shown in SMP (i.e., Facebook, Google+), however, only data from Twitter was used to determine the popularity of the web page. The numbers presented next to these icons were arbitrarily assigned.	4. Our primary source of data was Twitter. However, once we retrieved the top 20 most shared web pages from Twitter, we then used Bitly (URL shortening service, <a href="https://bitly.com/">https://bitly.com/</a> ) to extract information on how many times the web page was shared on other social media applications, including Facebook, Google+ and LinkedIn.

We incorporated design and functionality recommendations from the focus groups. These are described in Table 6.2. The updated version of the SMP prototype is shown in Figure 6.5.



Table 6.2 - Refined SMP prototype based on feedback from focus groups

Feedback from Focus Group	SMP Prototype (second iteration)
<b>Sessions</b>	
<b>Design (i.e., look and feel of SMP)</b>	
a. Display the title of the web page, since the size of the web page thumbnail is small and is not readable.	a. The title of the web page appears next to the web page thumbnails. In addition, the title “Pages Linked from Social Media” appears at the top of SMP, as shown in Figure 6.5 (h, i).
b. Display a zoomed version of the web page when the user hovers over the thumbnail so that the content of the web page is readable.	b. Users are able to hover over the web page thumbnail and it displays a zoomed version of the web page without clicking on the thumbnail, as shown in Figure 6.5 (j).
c. Display what the number/count represents.	c. Users are able to hover over the number and it displays what the number represents, as shown in Figure 6.5 (k).
<b>Functionality (i.e., information inside SMP)</b>	
d. If a web page is popular on multiple social media applications, display the information from these multiple social media applications, including the number/count.	d. Once the popularity of the web page was determined using Twitter data, we captured the popularity of the web page using Bitly. We then displayed the number of times the web page was shared on the social media site, including Facebook, Google+ and LinkedIn, as shown in Figure 6.5 (l).

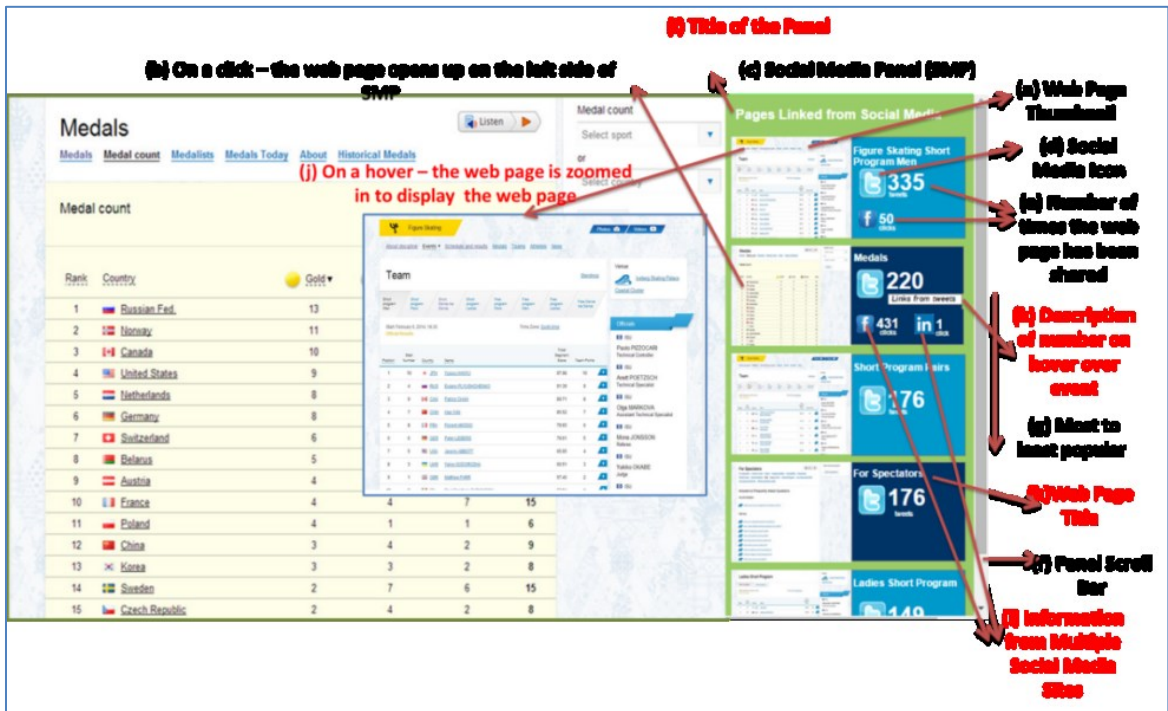


Figure 6.5 - Second Iteration of the SMP Prototype

## 6.3 User Study

### 6.3.1 Study Objective

The objective of this user study was to further evaluate the SMP prototype on a website and for a set of tasks. Moreover, we wanted to compare SMP with current navigation mechanisms within websites, such as menus, search and etc. The findings from the focus group sessions suggested that sports website would likely benefit from SMP and it will be more useful for browsing tasks rather than fact finding tasks. We therefore, selected the Sochi 2014 Olympics and evaluated the SMP prototype on this website. We decided to explore the usefulness for both browsing and fact finding tasks to answer our research questions.

### 6.3.2 Research Question

The following research question was part of this study:

**RQ4:** Does the use of links shared on social media, when aggregated and presented on websites, help users navigate websites more *effectively* and more *efficiently* than current navigation tools?

- a. Does the type of web task (fact finding or browsing) affect the *efficiency, effectiveness, or engagement* of navigation based on links shared in social media?

### 6.3.3 SMP Prototype for Sochi 2014

The Sochi 2014 Olympics were held from February 7, 2014 to February 23, 2014 in Russia, with an opening ceremony on February 6, 2014. Netlytic, which utilizes the Twitter Streaming API, was used to collect tweets. We collected over a million (1,596,399) tweets between the period of January 29, 2014 and February 25, 2014 and analyzed 1,661,357 links. Table 6.3 lists the keywords, the number of tweets and the number of links analyzed.

Table 6.3 – Sochi 2014 keywords, number of tweets and number of links

Keywords	Number of Tweets	Number of Links Analyzed
olympics (includes #olympics)	321,166	336,496
olympics2014 (includes #olympics2014)	79,134	75,079
sochi (includes #sochi)	622,783	663,278
sochi2014 (includes #sochi2014)	573,316	586,504
<b>Total</b>	<b>1,596,399</b>	<b>1,661,357</b>

The number of links analyzed is more than the number of tweets since one tweet may have contained multiple links. Once the top 20 links were determined, we used Bitly to collect the number of referrals from Facebook, Google+ and LinkedIn. The top 20 links and the number of times they appeared in tweets are illustrated in Table 6.4. The integration of this information in the SMP prototype is shown in Appendix 6.D.

Table 6.4 - Top 20 links from Sochi 2014

#	Sochi 2014 Web Page Links	Number of times shared
1	<a href="http://www.sochi2014.com/en/figure-skating-team-men-short-program">http://www.sochi2014.com/en/figure-skating-team-men-short-program</a>	335
2	<a href="http://www.sochi2014.com/en/medal-standings">http://www.sochi2014.com/en/medal-standings</a>	220
3	<a href="http://www.sochi2014.com/en/figure-skating-team-pairs-short-program">http://www.sochi2014.com/en/figure-skating-team-pairs-short-program</a>	176
4	<a href="http://www.sochi2014.com/en/spectators-faq">http://www.sochi2014.com/en/spectators-faq</a>	176
5	<a href="http://www.sochi2014.com/en/figure-skating-ladies-short-program">http://www.sochi2014.com/en/figure-skating-ladies-short-program</a>	149
6	<a href="http://www.sochi2014.com/en/medals">http://www.sochi2014.com/en/medals</a>	148
7	<a href="http://www.sochi2014.com/en/figure-skating-men-free-skating">http://www.sochi2014.com/en/figure-skating-men-free-skating</a>	143
8	<a href="http://www.sochi2014.com/en/schedule-and-results">http://www.sochi2014.com/en/schedule-and-results</a>	106
9	<a href="http://www.sochi2014.com/en/figure-skating-men-short-program">http://www.sochi2014.com/en/figure-skating-men-short-program</a>	97
10	<a href="http://www.sochi2014.com/en/figure-skating-ladies-free-skating">http://www.sochi2014.com/en/figure-skating-ladies-free-skating</a>	88
11	<a href="http://www.sochi2014.com/en/athlete-tatsuki-machida#.UvoD73LVbgE.twitter">http://www.sochi2014.com/en/athlete-tatsuki-machida#.UvoD73LVbgE.twitter</a>	81
12	<a href="http://www.sochi2014.com/en/snowboard-men-s-hp-qualification">http://www.sochi2014.com/en/snowboard-men-s-hp-qualification</a>	75
13	<a href="http://www.sochi2014.com/en/figure-skating-ice-dance-short-dance">http://www.sochi2014.com/en/figure-skating-ice-dance-short-dance</a>	65
14	<a href="http://www.sochi2014.com/en/snowboard-men-s-sbs-qualification">http://www.sochi2014.com/en/snowboard-men-s-sbs-qualification</a>	63
15	<a href="http://www.sochi2014.com/en/snowboard-men-s-hp-finals">http://www.sochi2014.com/en/snowboard-men-s-hp-finals</a>	52
16	<a href="http://www.sochi2014.com/en/snowboard-ladies-pgs-semifinals">http://www.sochi2014.com/en/snowboard-ladies-pgs-semifinals</a>	51
17	<a href="http://www.sochi2014.com/en/athlete-evgeni-plushenko">http://www.sochi2014.com/en/athlete-evgeni-plushenko</a>	50
18	<a href="http://www.sochi2014.com/en/figure-skating-pairs-short-program">http://www.sochi2014.com/en/figure-skating-pairs-short-program</a>	49
19	<a href="http://www.sochi2014.com/en/support-country">http://www.sochi2014.com/en/support-country</a>	44
20	<a href="http://www.sochi2014.com/en/team-independent-olympic-participant-athletes">http://www.sochi2014.com/en/team-independent-olympic-participant-athletes</a>	44

### 6.3.4 Study Design

This user study was conducted in March 2014. It was held in the Management building at Dalhousie University. Two laptops were used; one laptop was used by the participants to conduct the user study and the other was used by the researcher to observe the participant's behaviour while they completed the tasks, as shown in Figure 6.6. Several survey and software packages were used to conduct the user study including Opinio, Team Viewer 9, Morae and NVivo 10. Opinio, an online survey software, was used to collect participant's informed consent, responses to the demographic questionnaire, the post-task questionnaires and post-study questionnaires. Team Viewer 9, a remote desktop

software, was used to remotely observe participant's on-screen activity while they completed their tasks. Morae, a usability testing software, was used to record participant's on-screen activity including time and number of clicks. NVivo, a qualitative data analysis software, was used to code/categorize participant's responses to the open-ended questions as well as interview.

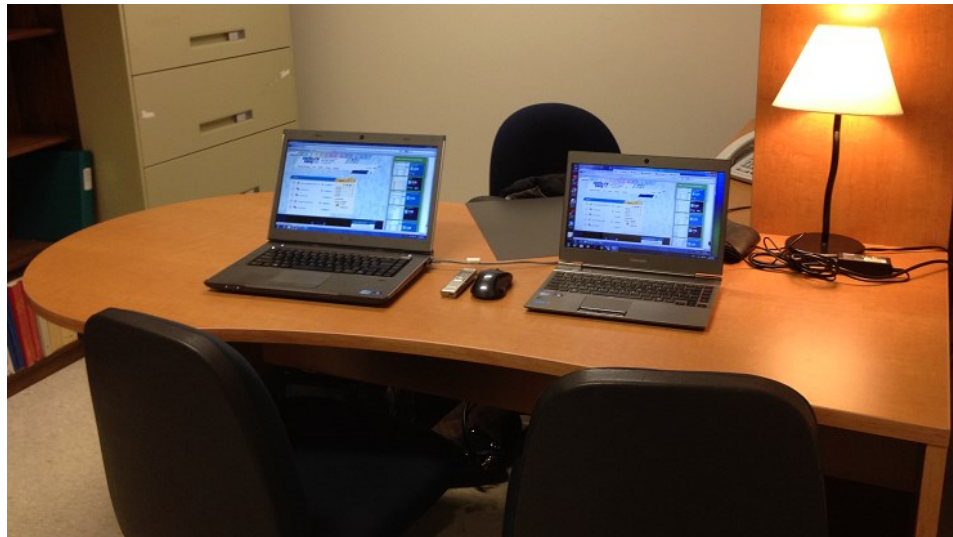


Figure 6.6 – User study setup

Participants were recruited by email to the Computer Science and Masters of Information Management email distribution lists and posters across campus. Participants were asked to sign the informed consent and fill out a demographic questionnaire online prior to arriving at the user study (see Appendix 6.E). The study took approximately an hour to complete. At the study, each participant was first given a study overview and trained on how to use the SMP prototype. We conducted a controlled user study, where participants were asked to take a few minutes to complete five tasks on the Sochi 2014 website, hence controlling the order effect. The tasks were either fact finding or browsing, of equal complexity, and were derived from previous studies (O'Brien, 2011; Erdelez, 2004; Miwa et al., 2011). Table 6.5 illustrates the five tasks and the estimated number of clicks required to complete the tasks.

Table 6.5 – Tasks and the estimated number of clicks to complete the task

Type of Task	Description	Estimate # of clicks required
<b>Fact finding Task 1</b>	Find the page which lists the results of the Figure Skating Ice Dance Short Dance Program and tell me the score of the 1st place winner?	1-2
<b>Fact finding Task 2</b>	Find the page which lists the results of the Ladies Figure Skating Short Program and tell me the score of the 1st place winner?	1-2
<b>Browsing Task 1</b>	You will be attending a social gathering this evening. It is a party to celebrate the recent Olympics (Sochi 2014). You do not know many of the guests in attendance but you know that they are into team sports. You thought it might be easier to meet new people if you were up-to-date on what happened at the Olympics. You decide to browse the Sochi 2014 website to see if there are any interesting items. Take the next few minutes to browse the site and find some interesting information to share at the party this evening.	N/A
<b>Browsing Task 2</b>	You will be attending a friend’s birthday party this evening. Your friend is into the recent Olympics (Sochi 2014). You know your other friends are into it too, especially the individual sports. You thought it might help to take part in the conversations if you were up-to-date on what happened at the Olympics. You decide to browse the Sochi 2014 website to see if there are any interesting items. Take the next few minutes to browse the site and find some interesting information to share with your friends.	N/A
<b>Task 5</b>	Take the next few minutes to browse the Sochi website to find something interesting that you did not already know and would like to share with your friends.	N/A

In total, participants completed two fact finding tasks either with the SMP or without the SMP and two browsing tasks either with the SMP or without the on the Sochi 2014 Olympics website. If the SMP prototype was presented, participants were asked to complete the task using the SMP and they were allowed to also use other navigation tools. For the fact finding tasks, the web pages containing the information were part of

the SMP prototype. Therefore, it was a within-subject experiment for the website as all participants used the website either with or without the SMP prototype twice; however, it was a between-subject experiment in terms of tasks and the SMP prototype. The order of task is illustrated in Table 6.6.

Table 6.6 – Order of tasks

Order ID	Task 1	Task 2	Task 3	Task 4	P=Prototype (SMP)
1	PF1	NB2	PB1	NF2	N=No Prototype (SMP)
2	PF2	NB1	PB2	NF1	B=Browsing
3	PB1	NF2	PF1	NB2	F=Fact finding
4	PB2	NF1	PF2	NB1	1=Task 1
5	NF1	PB2	NB1	PF2	2=Task 2
6	NF2	PB1	NB2	PF1	
7	NB1	PF2	NF1	PB2	
8	NB2	PF1	NF2	PB1	
9	PF1	NF2	PB1	NB2	
10	PF2	NF1	PB2	NB1	
11	NF1	PF2	NB1	PB2	
12	NF2	PF1	NB2	PB1	
13	NB1	PB2	NF1	PF2	
14	NB2	PB1	NF2	PF1	
15	PB1	NB2	PF1	NF2	
16	PB2	NB1	PF2	NF1	

After the four tasks, participants were asked to complete the fifth task where they were asked to just browse and find something interesting. The SMP prototype was visible for the fifth task and participants had the option to use it if desired. The study concluded with a post-study questionnaire and a semi-structured interview, as shown in Figure 6.7.

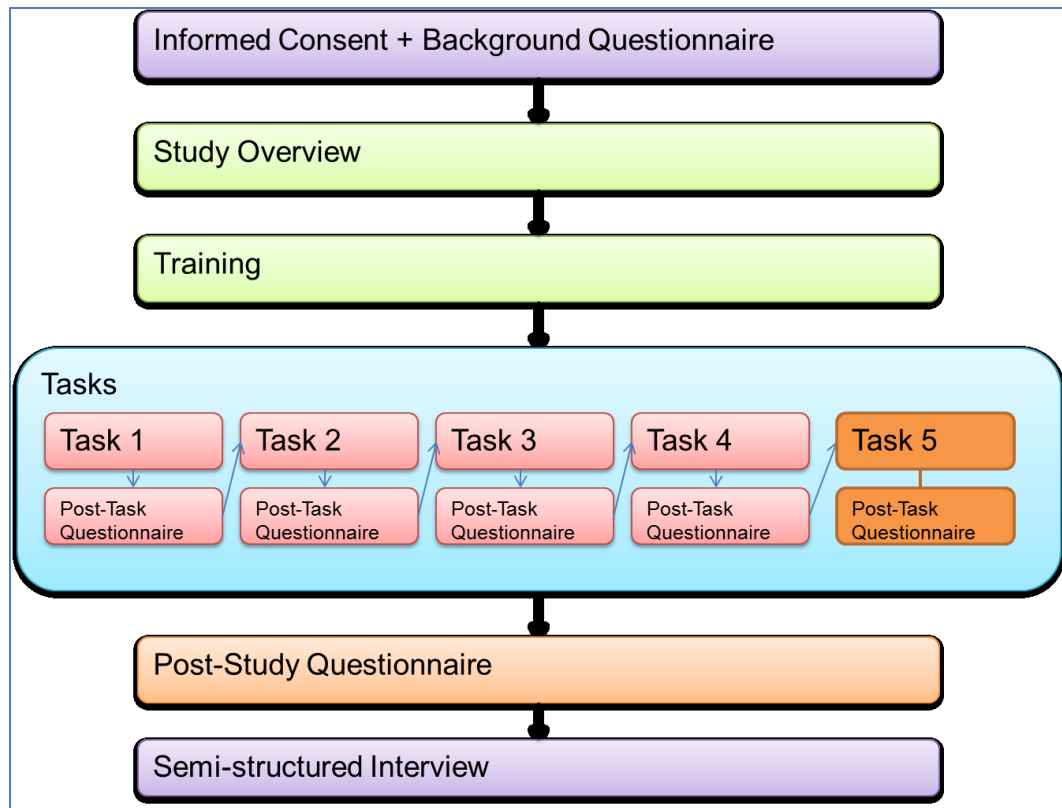


Figure 6.7 - User study design

All participants were compensated \$20 for finishing the user study.



### 6.3.5 Results

Thirty-four Dalhousie University students (18 male and 16 female) participated in the user study between the ages of 18 to 35 (74% (25/34) between the ages of 18 to 25 and 26% (9/34) between the ages of 26 to 35). There were 23 students from the Faculty of Computer Science (Computer Science, Informatics), 5 from the Faculty of Management, 4 from the Faculty of Science (Biology, Psychology, Marine Biology), 1 from the Faculty of Arts and Social Science and 1 from the Faculty of Health Professions (Kinesiology). There were 16 graduate students (Masters, PhD) and 18 undergraduate students who participated in this study.

A total of 7,582 data points were collected during the entire user study, as illustrated in Table 6.7.

Table 6.7 - Data collection points from the user study

<b>Items</b>	<b># of Questions</b>	<b># of Questions X 34 (Total Participants)</b>
Demographic Questionnaire	41	1,394
Task 1: Post-task Questionnaire – NF	20	680
Task 2: Post-task Questionnaire – NS	20	680
Task 3: Post-task Questionnaire – PF	23	782
Task 4: Post-task Questionnaire – PS	23	782
Task 5: Post-task Questionnaire	25	850
Post Study Questionnaire	50	1,700
Interview	11	374
<b>Total</b>	<b>213</b>	<b>7,242</b>
<b>Items</b>	<b># of Times Collected</b>	<b># X 34</b>
Time	5	170
Number of Clicks	5	170
<b>Total</b>	<b>10</b>	<b>340</b>

### 6.3.5.1 Qualitative Results

Data was collected from demographic questionnaire (5-point Likert scale), post-task questionnaire (Likert scale and open-ended questions), post-study questionnaire (Likert scale and open-ended questions) and semi-structured interviews (see Appendix 6.E, 6.F, 6.G, 6.H, 6.I and 6.J). The data gathered from Likert scale questions were quantitatively analyzed. Participants' responses to open-ended questions and comments were coded in NVivo and analyzed to provide insights.

#### a. Data from Demographic Questionnaire

The demographic questionnaire was used to capture three main pieces of information about the participants: a) their frequency of using social media applications; b) the types of activities they perform on social media applications; and c) whether they mostly share or post links on social media applications.

The top three most frequently used social media applications among the participant were: Facebook, YouTube and Instant Messaging, as shown in Figure 6.8. Laptops/desktops and/or mobile phones were used by 94% (32/34) of the participants to access these social media applications.

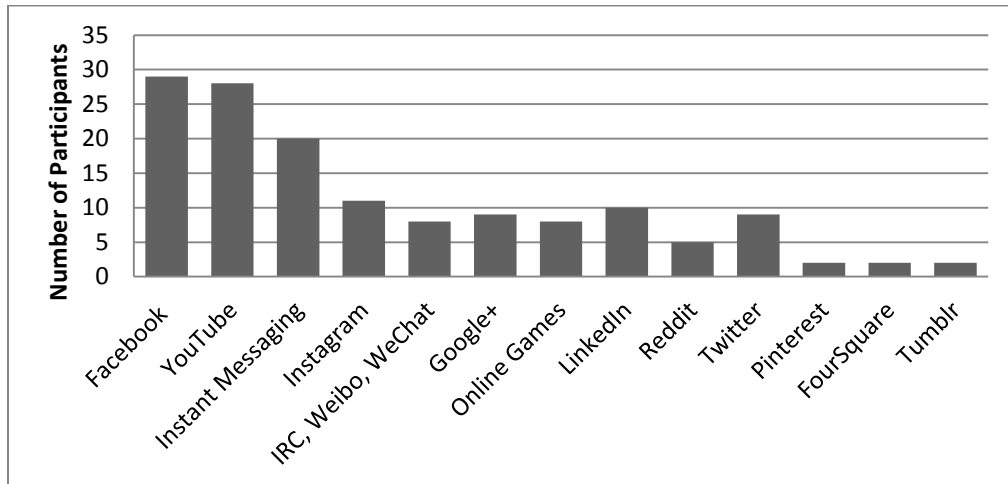


Figure 6.8 – Most frequently used social media applications

Participants were asked to rate how often they perform various activities on social media (share pictures, share links, view pictures, click on links, etc.). The activities were broken

down to determine whether participants were contributors/sharer of information or viewers or both. Majority of the participants were viewers (i.e., 79% (27/34) very frequently read comments, 76% (26/34) very frequently read status updates, 76% (26/34) very frequently viewed photos, 68% (23/34) very frequently watched videos, 62% (21/34) very frequently followed/clicked on links (URLs)). Fifty-nine percent (20/34) of the participants indicated that they recommend/like items on social media, which constitutes to contributing/sharing social media information. Ninety-seven percent (33/34) of the participants indicated that they perform these activities using the social media site itself (i.e., by directly accessing Facebook, Twitter, etc.), as shown in Figure 6.9.

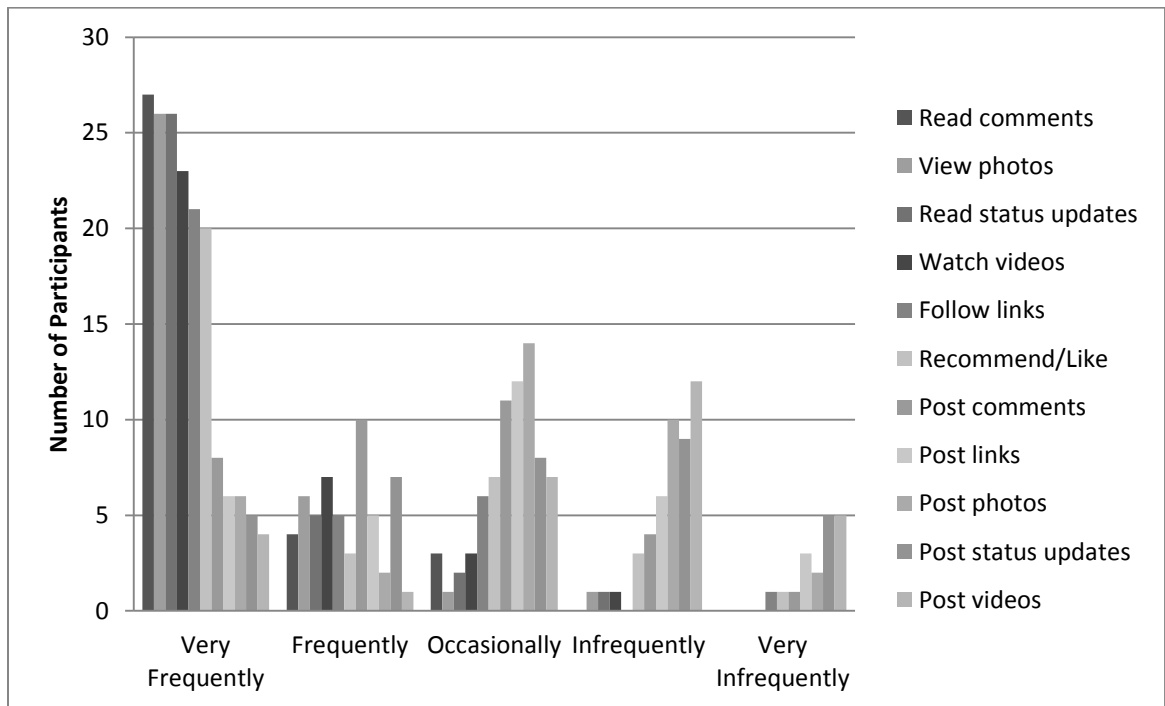


Figure 6.9 - Activities on social media applications

Participants were asked to rank the top three social media application that they use to share/post links (URLs) and follow/click on links (URLs), as shown in Figure 6.10 and Figure 6.11. Facebook, YouTube and Instant Messaging ranked as the top three social media applications for sharing/posting links (URLs). Facebook, Twitter and YouTube ranked as the top three social media applications for following/clicking on links (URLs). It is interesting to note that participants used Twitter mostly for clicking/following links

(44%, 15/34) and not so much as a platform for sharing/posting links (26%, 9/34). Perhaps this is a result of our participants being mainly viewers of information rather than contributors.

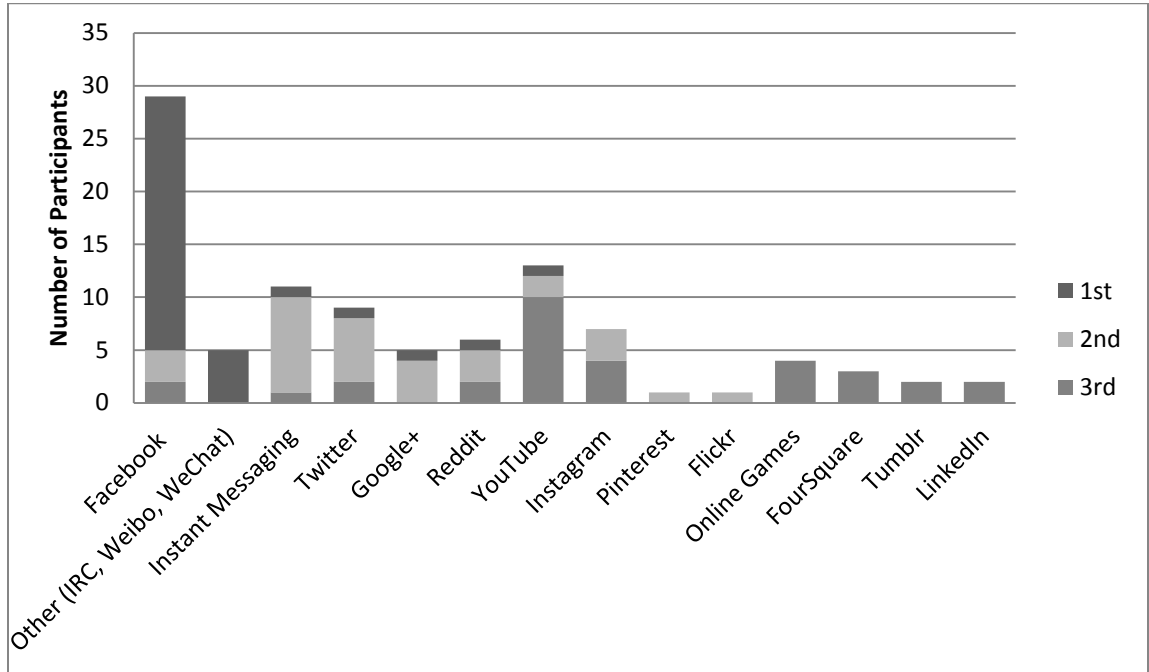


Figure 6.10 - Link Sharing

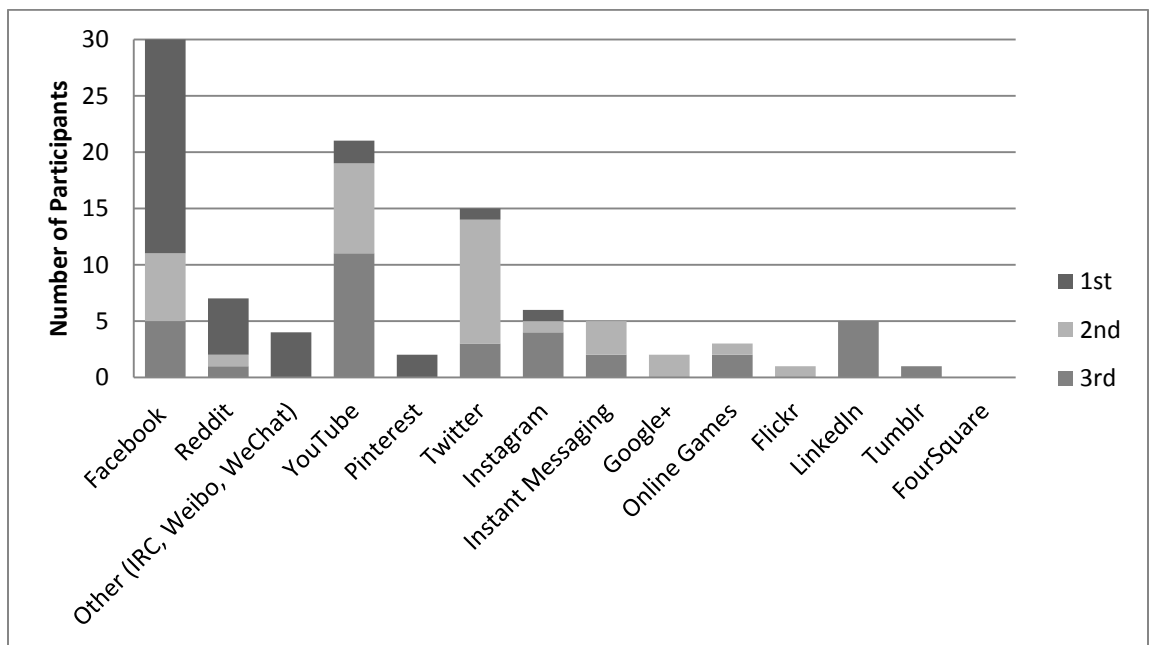


Figure 6.11 - Link Following

### *b. Data from Post-Task Questionnaires*

Participants were asked to complete a post-task questionnaire after each of the five tasks. There were three variations of the post-task questionnaire: one for task without the SMP, one for task with the SMP, and one for task 5, as shown in Appendix 6.F, 6.G and 6.H.

#### **Usage of navigation tools**

Participants were asked to indicate which navigation tool they used to complete their tasks (fact finding task and browsing task either with or without SMP and task 5 with SMP). Figure 6.12 illustrates the navigation tool(s) participants used to complete the tasks when they were presented with and without SMP on Sochi 2014 website. Without SMP, 94% (32/34) used menus for fact finding tasks and 97% (33/34) used menus for browsing tasks. A total of 79% (27/34) used links within the web page to complete fact finding tasks and 97% (33/34) used links within the web page to complete browsing tasks. Therefore, majority used menus and links within the web page to complete the tasks. Moreover, 65% (22/34) used web browser tools for browsing tasks compared to only 32% (11/34) who used web browser tools for fact finding tasks. Few participants used search to complete both fact finding and browsing tasks (32% (11/34) for fact finding tasks and 35% (12/34) for browsing tasks).

With SMP, all participants used SMP for both fact finding and browsing tasks. We notice the usage of all the other navigation tools (menus, search, links within the web page and browser tools) dropped significantly. However, the usage of navigation tools (such as links within the web page, menus, browser tools and search) remained more for browsing tasks than fact finding tasks. This means that SMP, although used by all participants, needs to be treated as an alternate form of navigation on a website and that SMP alone on a website will not be sufficient.

For task 5, where participants had the option to either use SMP or choose not to, we noticed that majority (94%) used it to complete their task. We also noticed that they used

links within the web page (82%) and menus (76%) more than the browser tools (50%) and search (26%). This informs us that on a website, navigation tools such as menus, links within the web page are important and that SMP does not replace existing navigation tools (such as menus and links within the web page) and that multiple navigation tools are required to complete information seeking tasks on websites.

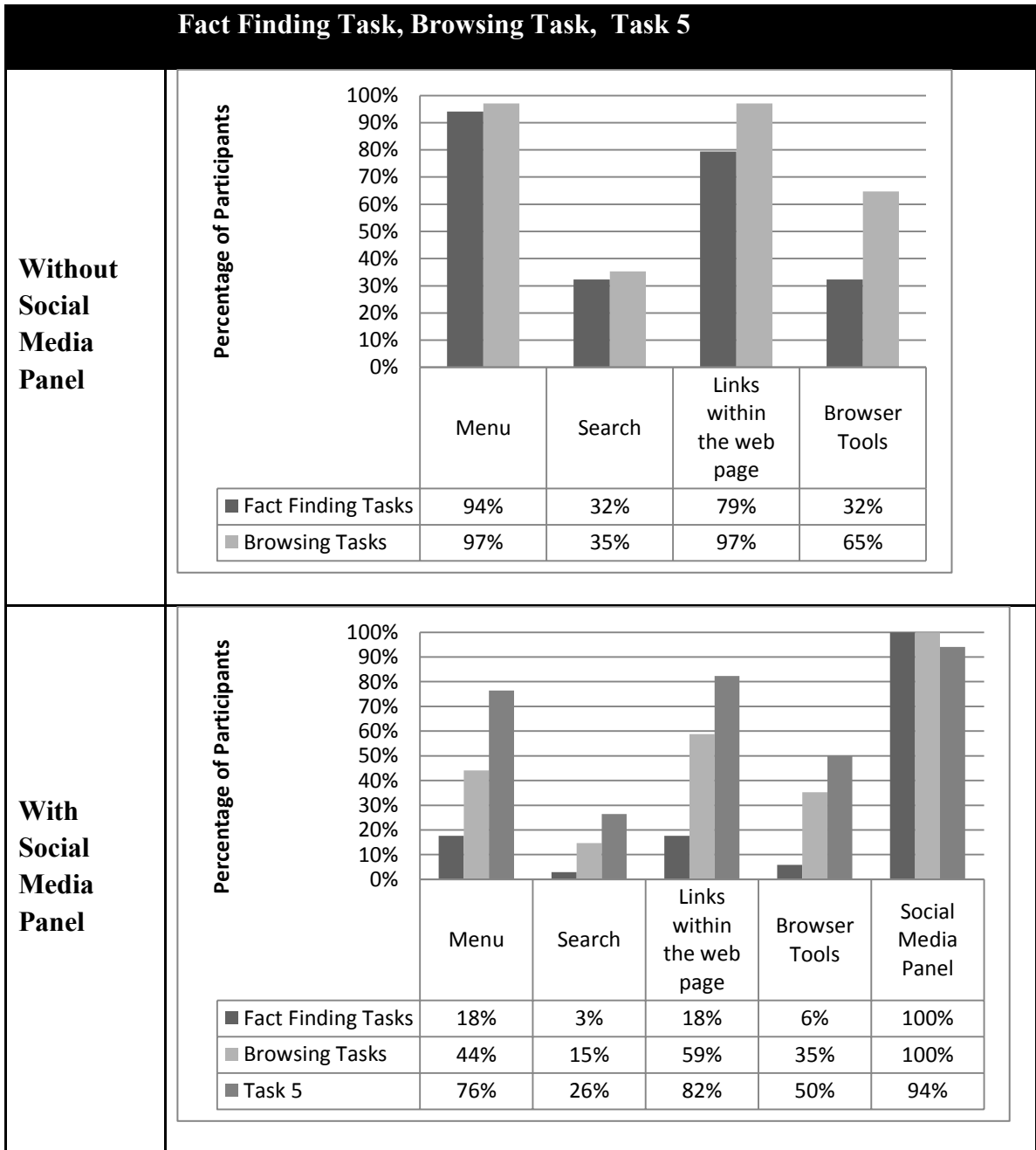


Figure 6.12 – Usage of navigation tools (with and without SMP)

For fact finding tasks with SMP, 88% (30/34) of the participants found SMP to be very useful when completing the task. Search was not used by any participant to complete the fact finding task with SMP. For browsing tasks with SMP, 71% (24/34) of the participants found SMP to be very useful when completing the task. Links within the web page were deemed to be the next very useful navigation tool (35%, 12/34) followed by menus (19%, 6/34).

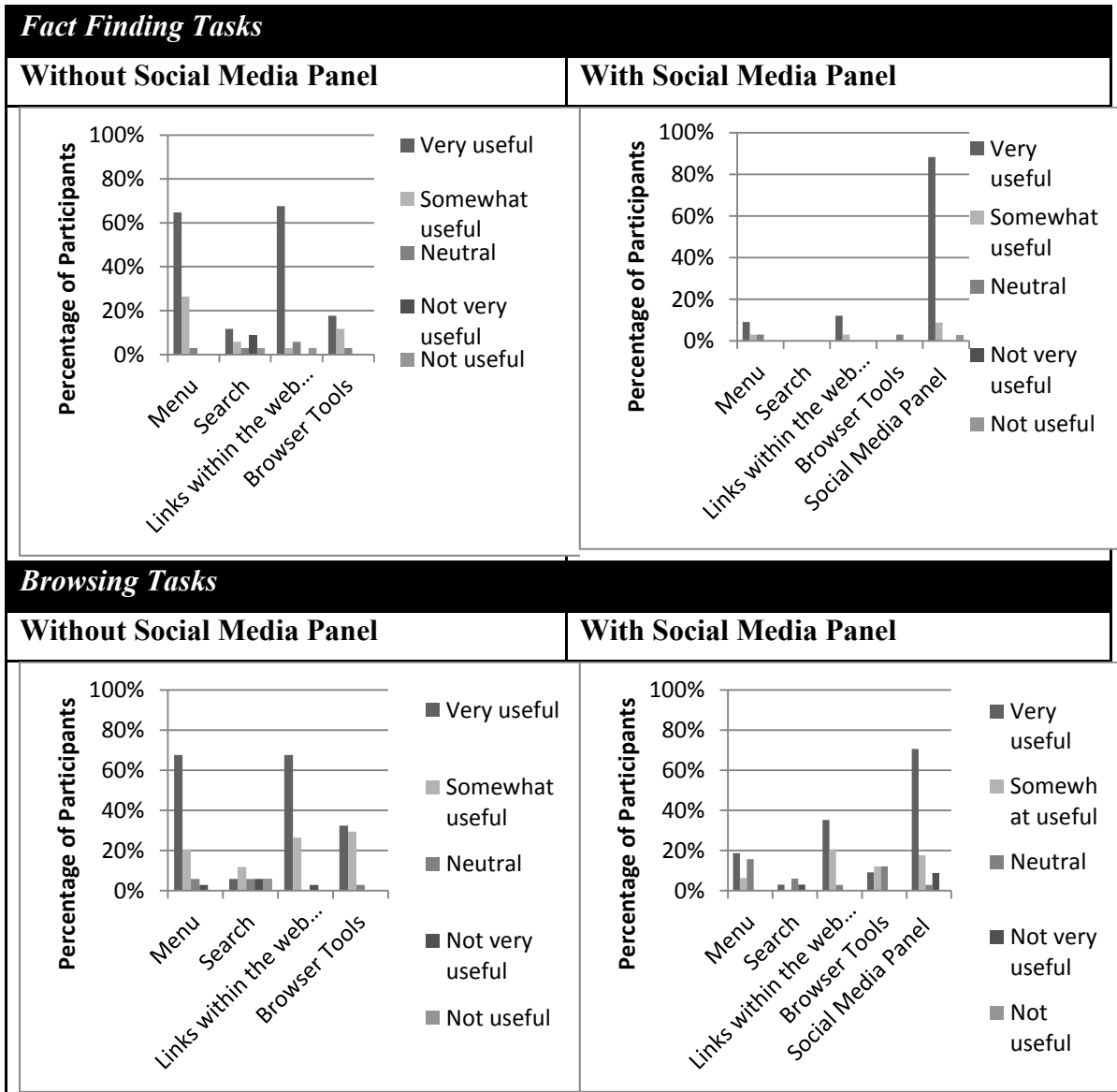


Figure 6.13 - Usefulness of navigation tools (with and without SMP)

For task 5, where participants had the option to choose any navigation tool(s) including SMP, 50% (17/34) of the participants found SMP to be very useful and 38% (13/34) found it to be somewhat useful when completing the task, as shown in Figure 6.14. Links within the web page were deemed to be the next very useful and somewhat useful navigation tool (41%, 13/34 and 31%, 10/34) followed by menus (39%, 13/34) and browser tools (21%, 7/34). Search was considered to be not very useful.

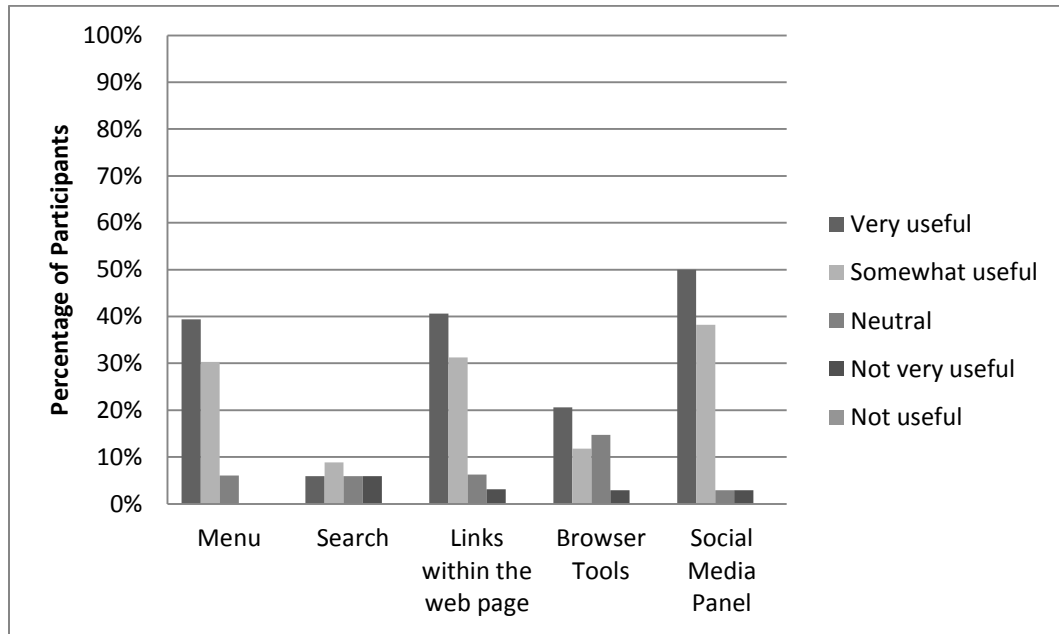


Figure 6.14 - Usefulness of navigation tools – Task 5 (with SMP)

**Most useful navigation tool:**

More than 50% of the participants indicated that they found menus to be the most useful when completing both the fact finding and browsing task when presented without SMP (50% (17/34) for fact finding and 59% (20/34) for browsing), as shown in Figure 6.15. The second most useful was the links within the web pages (32% (11/34) for fact finding and 38% (13/34) for browsing tasks). Participants indicated search and browser tools to be the least useful when completing both the fact finding and browsing task.



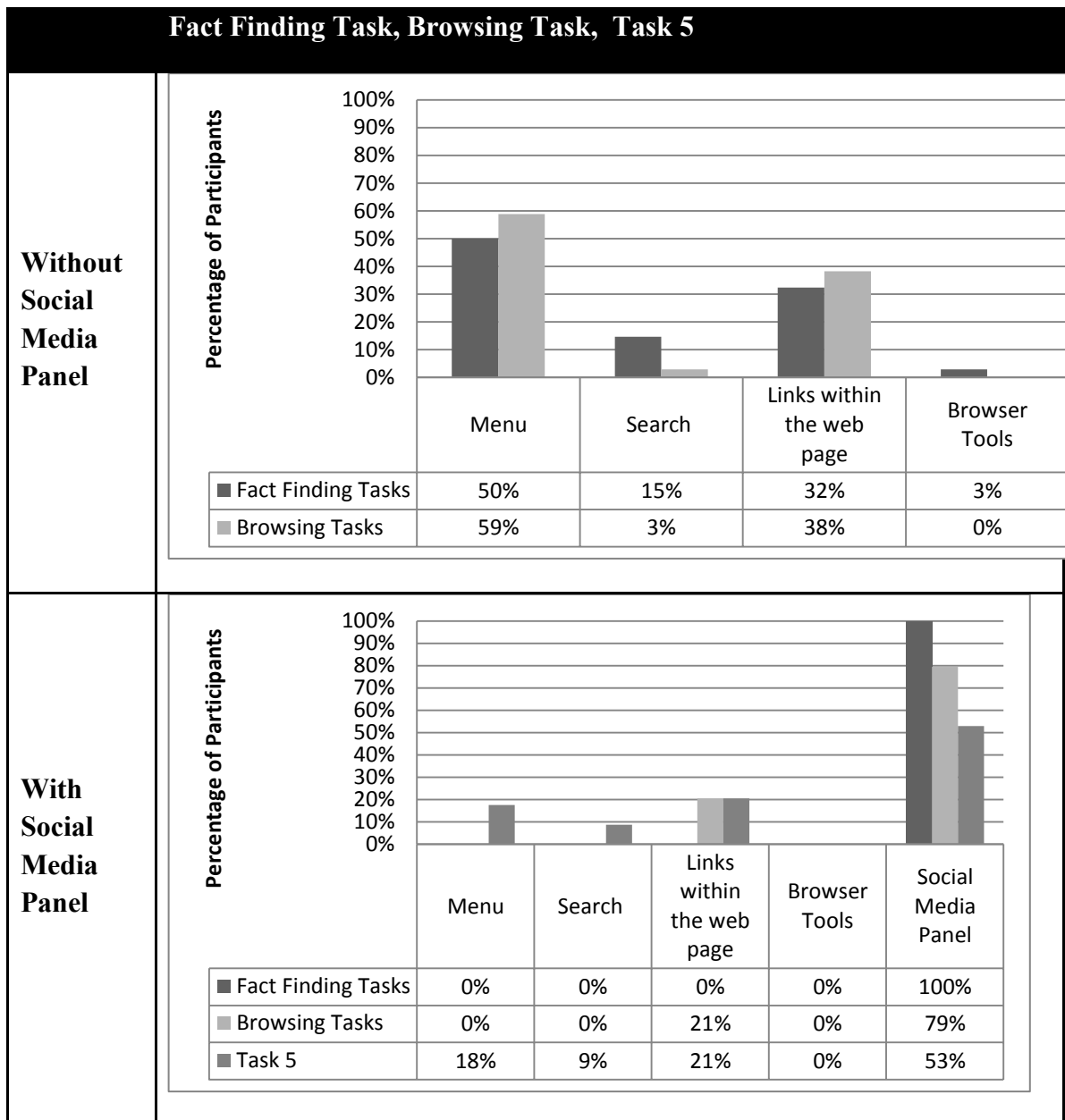


Figure 6.15 – The most useful navigation tool (with and without SMP)

When participants were presented with the SMP, they found SMP to be the most useful in completing both the fact finding and browsing task (100% (34/34) for fact finding and 79% (27/34) for browsing tasks). Links were the second most useful navigation tool for browsing task. These results show that participants found SMP to be the most useful in completing both types of tasks.

For Task 5, where participants were presented with SMP but not required to use it, 53% (18/34) found SMP to be the most useful. In addition, some participants (21% and 18%) found links within the web pages and menus to be more useful than other navigation tools. This means that SMP alone on a website will not suffice and that it must co-exist with other navigation tools (such as, menus and links within the web page) to cater to different types of users.

Using an open-ended question in the post-task questionnaire, participants were further asked to explain why they found the navigation tool to be the most useful. All responses to the open-ended question were in textual format. From Opinio, the responses to the questions were imported into NVivo for coding. Nodes were created as common themes emerged from the data. All coding was conducted manually by reading each participant's response to the question. For fact finding and browsing tasks without SMP, participants found menus to be easy to find, organized, provided direct access to information and helped them navigate from one page to another. Some indicated that search did not provide them with the information and therefore, they reverted to menus.

For fact finding tasks with SMP, all participants found SMP to be easily accessible and provided them with quick access to information. One participant indicated that SMP was useful in showing previews of the web pages which helped them find information quickly. They also indicated that if there was a search text box embedded in SMP that they would use it directly. For browsing tasks with SMP, participants found SMP to be quick and efficient along with easy to use.

*“The social media panel was the most useful because I was able to find information that other people shared on social media websites that seemed to interest them so using those links I was able to find out some points I could bring up at my party.” P31*

*“Helped me navigate to interesting topics about team sports.” [P13]*

*“The media panel provides good information for popular but limited information based on the popularity. However, it did provide a very quick and efficient way of*

*gathering wanted information if and only if the link is provided in the Social Media Panel.” [P29]*

*“The overview page provided by Social Media Panel let me compare the contents in two pages easily.” [P36]*

*“I had a hard time deciding what to actually look up - eventually I settled for something that was included on the social media panel and went with it, but not because I was actually interested in the link that was on the social media panel - it just suited my needs at the time.” [P08]*

For task 5, 53% of the participants indicated they found SMP to be the most useful as it provided them with quick access to information, directed them to a link which was popular, and it was a good starting point. They also indicated they found the preview feature of the web page to be useful and the SMP easy to use.

### **Task Clarity**

Participants’ responses to the statement “The task was clear (I understood what to do)” was collected using Likert scale. It was determined that all participants found fact finding tasks to be clear and they understood what to do. The majority (85% (29/34) for without SMP and 82% (28/34) with SMP) also understood the browsing task. However, there were two participants who did not find the task to be clear and one selected “neutral” for Task 5.

### **Ease of Use**

Participants’ response to the statement “*It was easy to complete this task*” was collected using Likert scale. The participants strongly agreed that the fact finding tasks were easy to complete in both interfaces (82% (28/34) with the SMP and 71% (24/34) without the SMP). Browsing tasks were easy to complete with the SMP (56% (19/34) more so than without the SMP (47% (16/34)), as shown in Figure 6.16 (a) and Figure 6.16 (b).

Participants’ response to the statement “*I found specific information on the website*” was collected using Likert scale. Participants mostly agreed strongly that they were able to find the specific information easily when completing fact finding tasks on both interfaces

(with SMP and without the SMP). However, for browsing tasks, participants rated it lower than fact finding tasks and this could be due to the nature of browsing tasks.

Participants' response to the statement "I found the website easy to browse" was collected using Likert scale. The majority of the participants strongly agreed that they found the website easy to browse for fact finding tasks on both interfaces (with SMP (71%) and without the SMP (56%)).

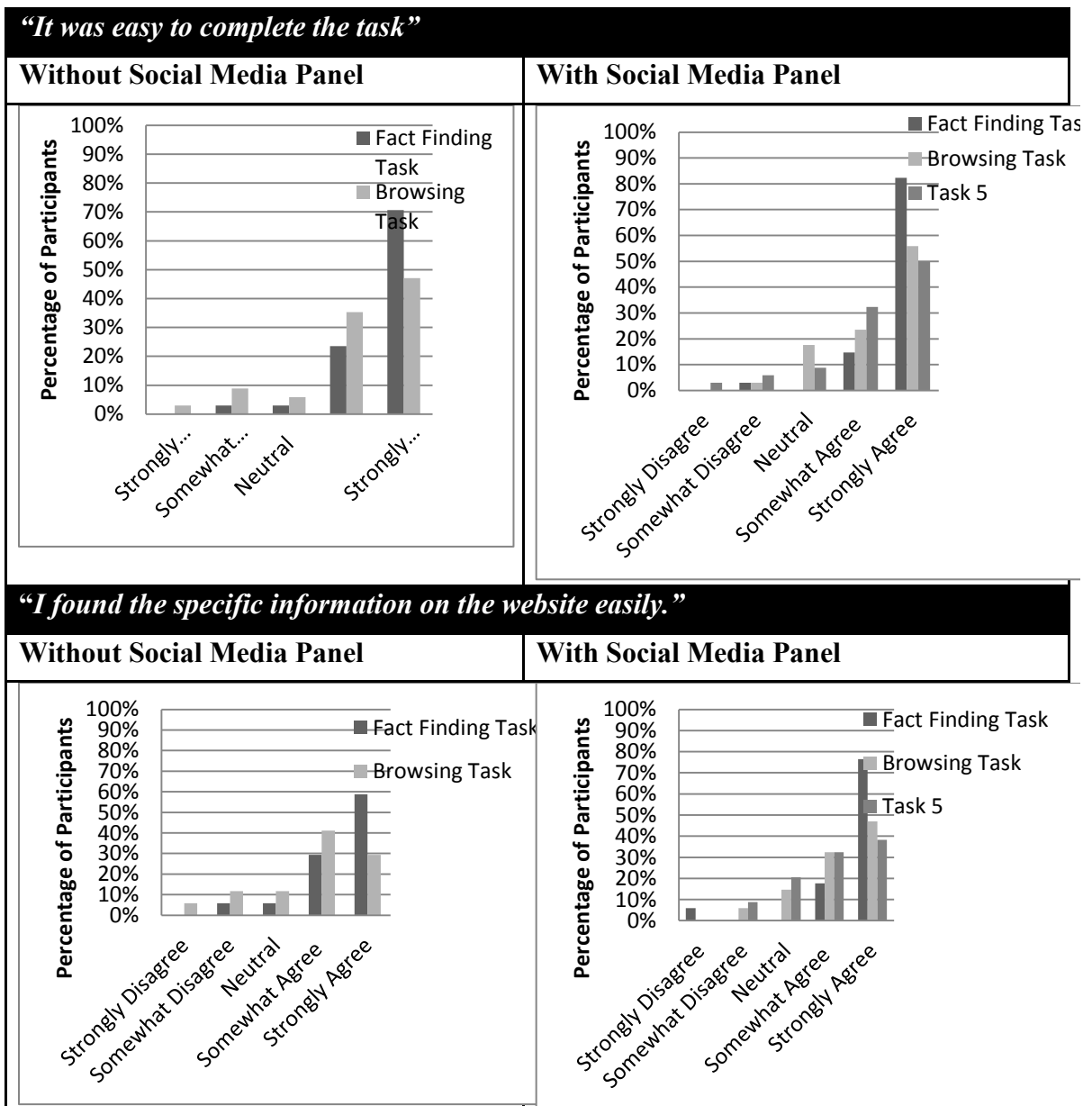


Figure 6.16 (a) – Ease of use (with and without SMP)

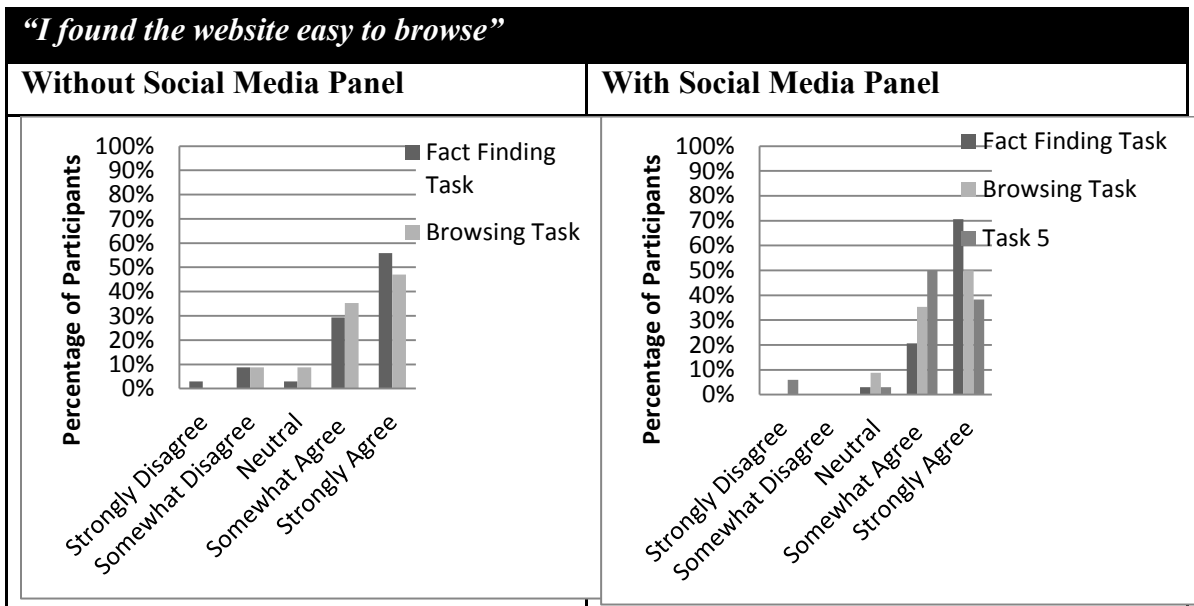


Figure 6.17 (b) – Ease of use (with and without SMP)

### **Task Completion**

More than 85% (29/34) of the participants strongly agreed that they felt they completed the task successfully for fact finding tasks on both interfaces (with SMP (88%) and without the SMP (85%)). For browsing task, only 62% indicated they strongly felt that they completed the task successfully for both interfaces, as shown in Figure 6.17.

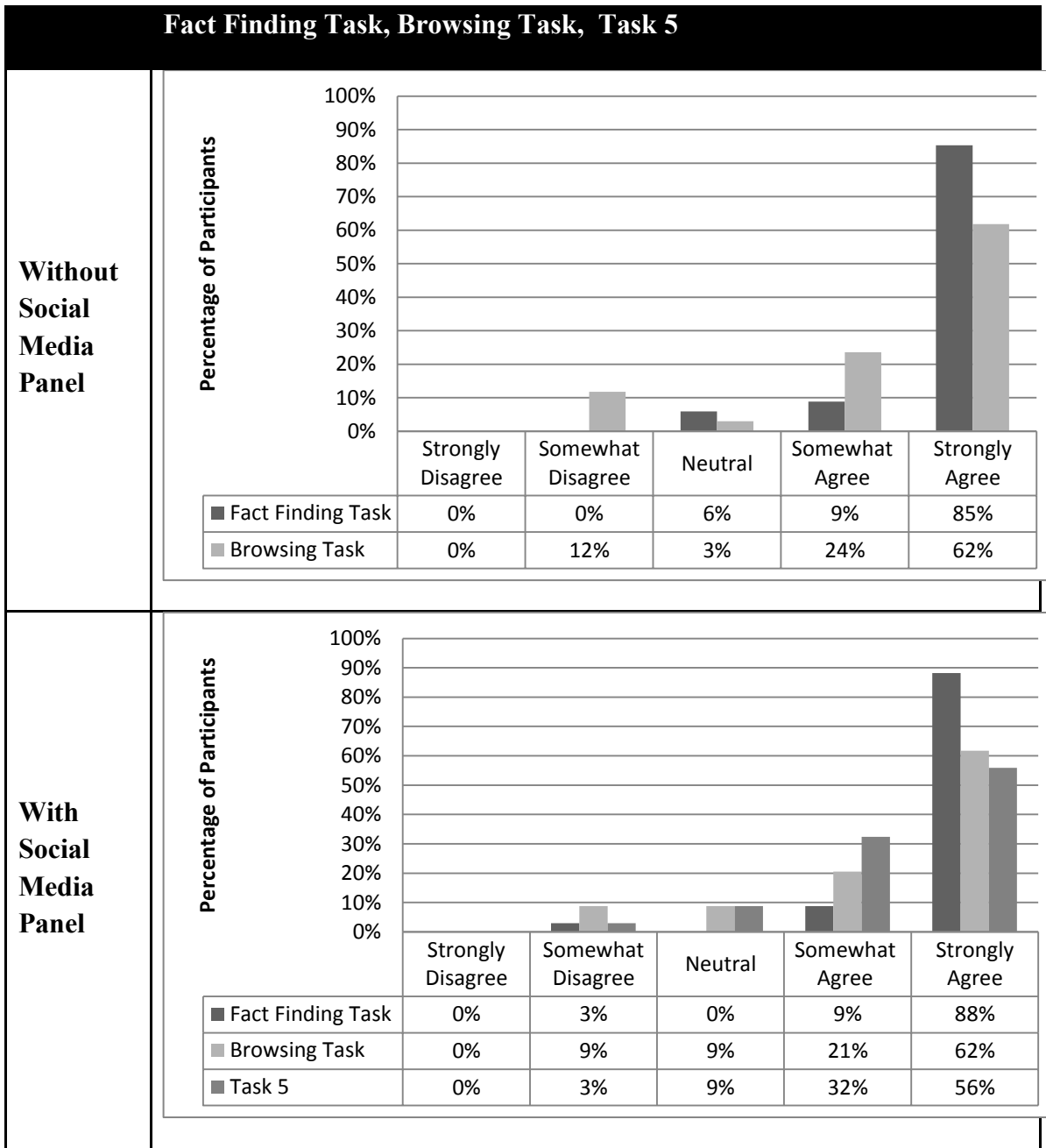


Figure 6.18 – Task completion (with and without SMP)

**Usefulness of the Navigation Tools**

The majority of the participants agreed to the statement “*I found the navigation tools I used to be useful*” and more than 50% of the participants strongly agreed that they found

the SMP to be useful/helpful in completing the tasks (fact finding (94%, 32/34), browsing (65%, 22/34) and task 5 (50%, 17/34)), as shown in Figure 6.18.

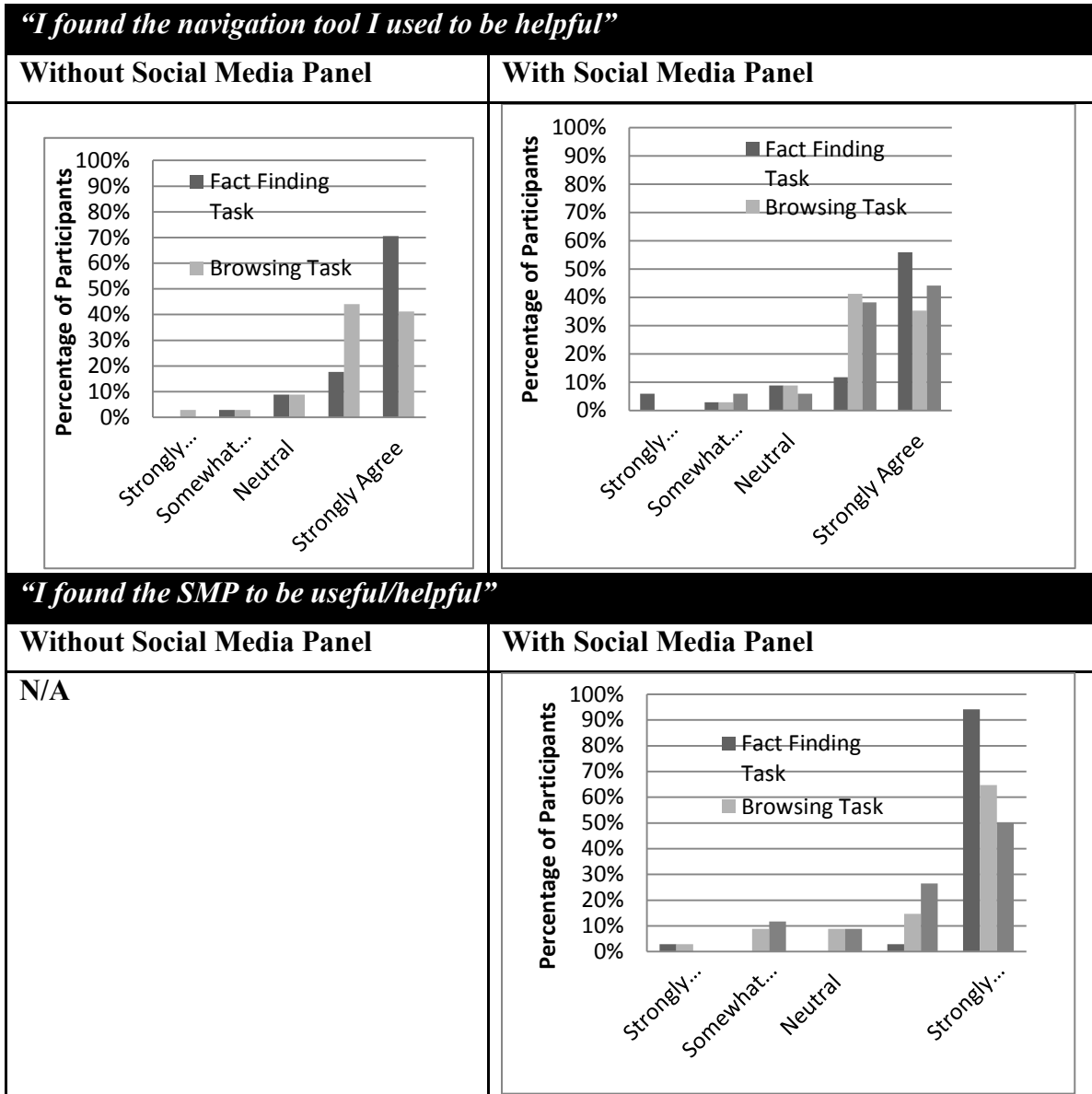


Figure 6.19 – Usefulness of navigation tools (with and without SMP)

### **Task Efficiency**

More participants agreed to the statement “*I felt that I completed the task quickly*” for fact finding tasks than browsing tasks (44% vs. 15%), as shown in Figure 6.19. With the SMP, participants indicated that they felt that they completed the task quickly for fact finding task more than the browsing task (76% vs. 35%). This could be due to two reasons: a) the nature of browsing task; or b) the answers to the fact finding tasks were either two clicks away from the home page or they were embedded in one of the web pages in the SMP. More participants agreed to the statement “*I felt that I was able to get to the web page directly without visiting multiple web pages*” for fact finding tasks than the browsing tasks (74% vs. 53%) with SMP. It is interesting to note that without SMP, participants found that they had to visit multiple pages to complete the task (only 32% and 24% strongly agreed to the statement).

### **Fun**

Participants were asked to rate whether “completing this task was fun”. The majority of the responses (over 90%) ranged from neutral to strongly agree, as shown in Figure 6.20.

### **Frustration**

The majority of the participants strongly disagreed to the statement “*I felt frustrated while doing this task*” when completing the task without SMP (both fact finding (70%) and browsing (50%) tasks), as shown in Figure 6.21 (a) and Figure 6.21 (b). Furthermore, majority (90%) strongly disagreed that they felt frustrated while doing the fact finding task with the SMP. Some did feel frustrated while doing the browsing tasks (24%) and task 5 (15%).

The majority disagreed that they found navigating the website to be confusing (for both fact finding (72%) and browsing (67%) tasks) without SMP. Furthermore, majority disagreed that they found navigating the website to be confusing while doing the fact finding task with the SMP (88%).



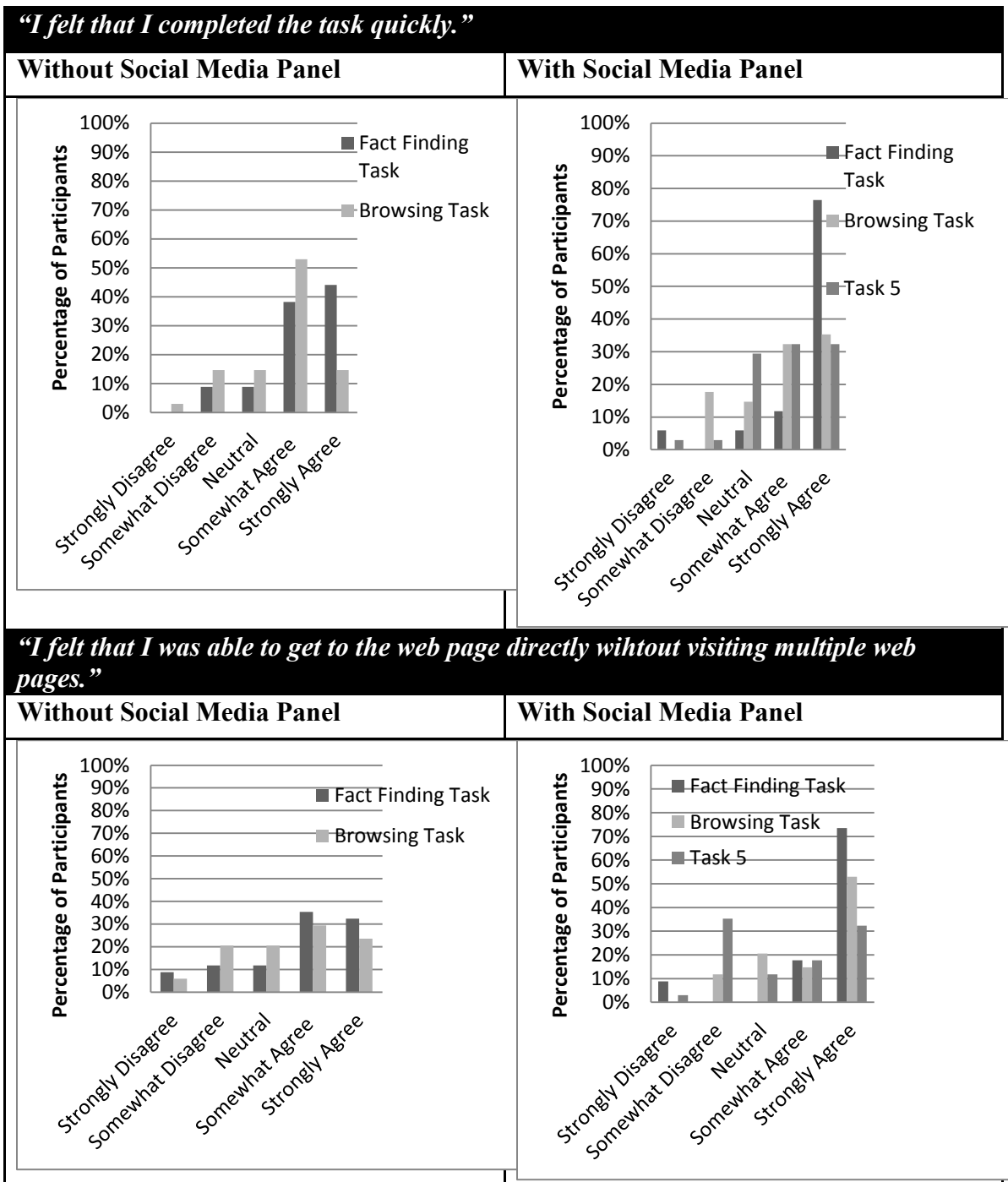


Figure 6.20 – Task efficiency (with and without SMP)

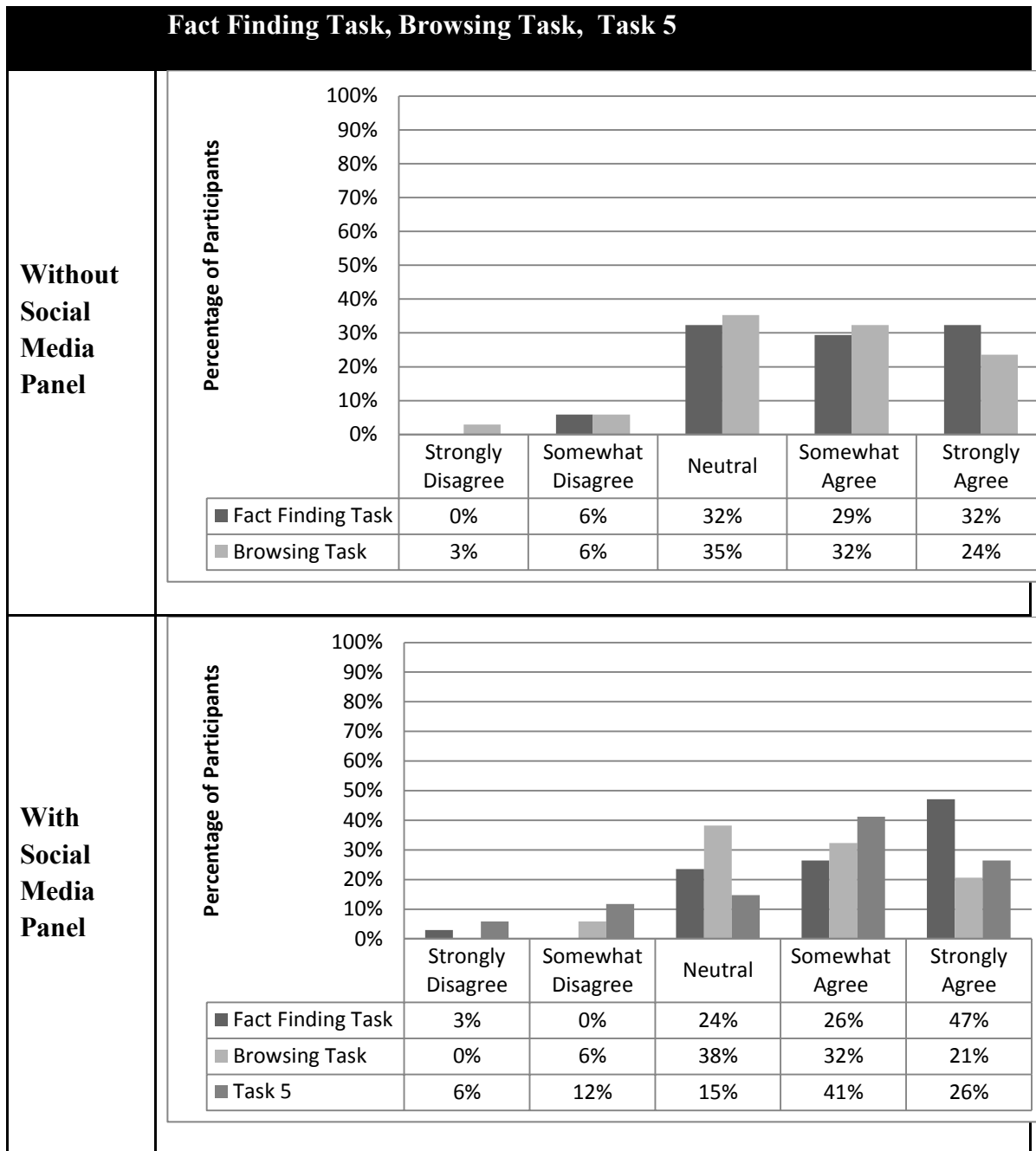


Figure 6.21 – Fun (with and without SMP)

The majority strongly disagreed that they felt annoyed navigating the website (for both fact finding (56%) and browsing (47%) tasks) without SMP. Furthermore, majority strongly disagreed that they felt annoyed navigating the website with the SMP for fact finding tasks (82%), browsing tasks (53%) and task 5 (50%). Eighty-five percent of the

participants strongly disagreed that they found SMP to be confusing to use for fact finding tasks, 68% for the browsing task and 71% for task 5.

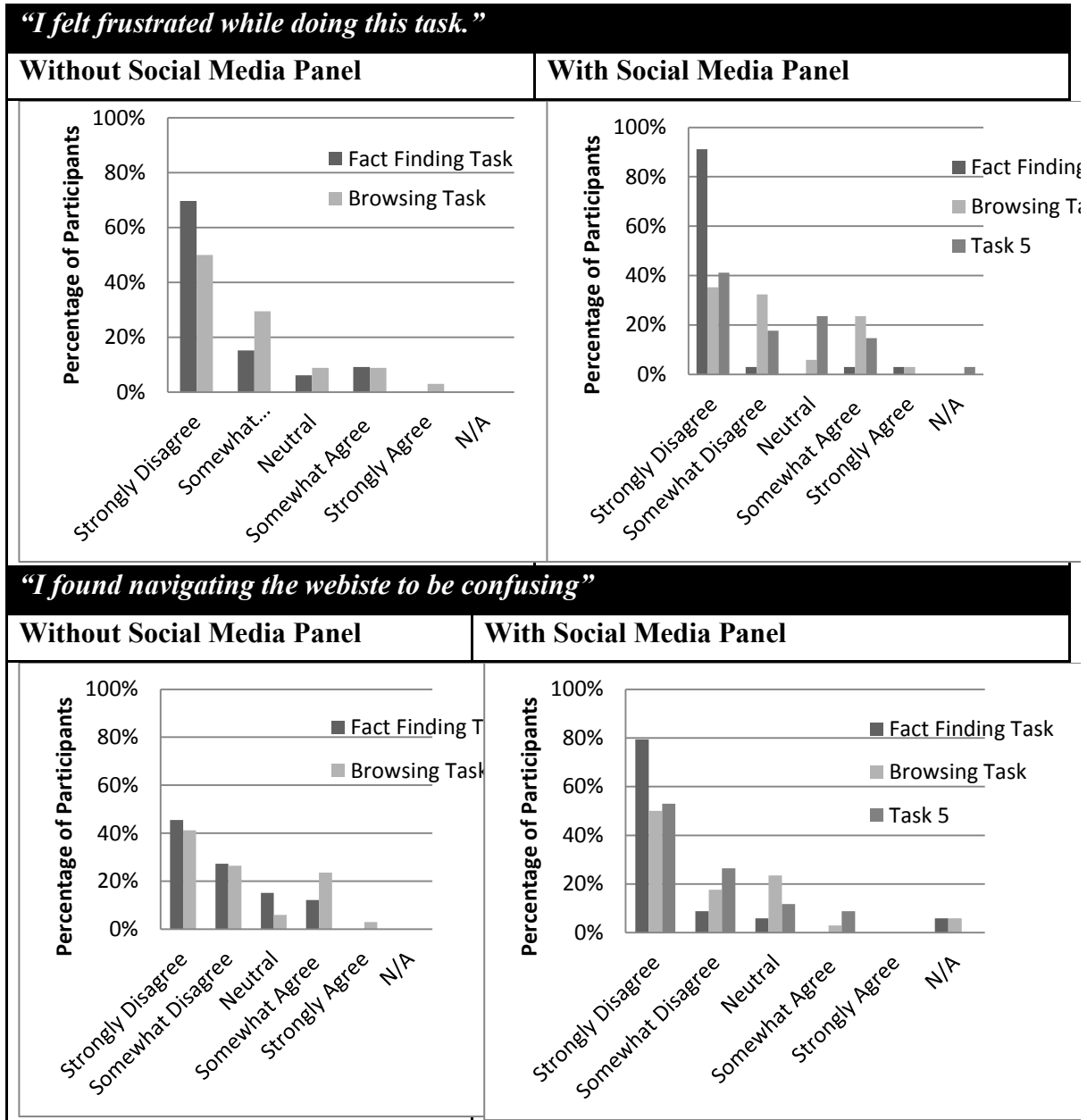


Figure 6.22 (a) – Frustration (with and without SMP)

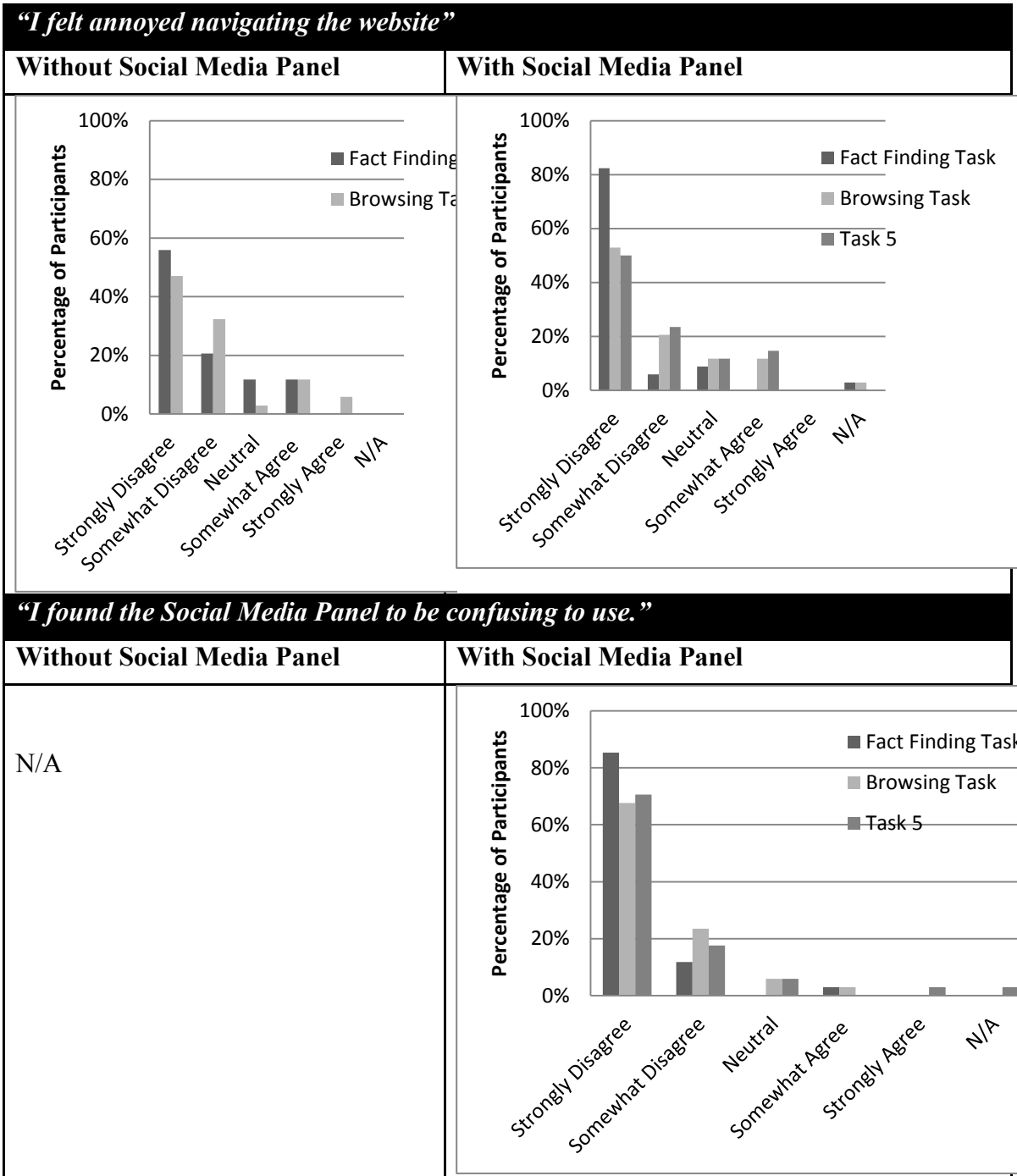


Figure 6.23 (b) – Frustration (with and without SMP)

### *c. Data from Post-Study Questionnaire*

After completing all five tasks and post-task questionnaires, participants were asked to complete a post-study questionnaire. The questions used in the post-study questionnaire are described in Appendix 6.I.

#### **Participants' Knowledge of Sochi 2014**

Seventy percent (24/34) of the participants followed/watched the Sochi 2014 Olympics and 30% (10/34) indicated that they did not follow/watch the Sochi 2014 Olympics. From these, 76% (26/34) were mainly supporting team Canada. Some, 61% (21/34) of the participants, watched hockey and 36% (12/34) were moderately familiar with the Sochi 2014 website prior to the user study. Aside from Sochi 2014 website, participants visited several other websites such as, news (CBC, BBC), sports (TSN), blogs, etc. Some, 50% (17/34) of the participants indicated that they did not use social media for the Sochi 2014 Olympics. Whereas, 26% (9/34) indicated that they followed links from friends on social media, 15% (5/34) shared information (i.e., tweeted, liked, etc.) and 9% (3/34) did both.

#### **SMP (Ease of use, effective, efficient and understanding)**

Using the 5-point Likert scale, we asked participants to rate their responses to some generic statements regarding SMP. The majority, 76% (26/34) of the participants strongly agreed that the SMP was easy to use. Participants (41%) strongly agreed that they liked using the SMP and 38% somewhat agreed. Participants (47%) strongly agreed that they found SMP to be effective and 44% strongly agreed that they found SMP to be efficient. Only 29% of the participants strongly agreed that the SMP helped them remember where they have been on the website and some disagreed (21% somewhat disagreed and 9% strongly disagreed). Participants (44%) strongly agreed that they would use SMP on websites and the remaining participants were either neutral or somewhat agreed. A total of 88% (29/34) of the participants strongly agreed that they understood what the information inside the SMP represented and 91% (30/34) strongly agreed that they understood what the numbers next to the SMP meant.

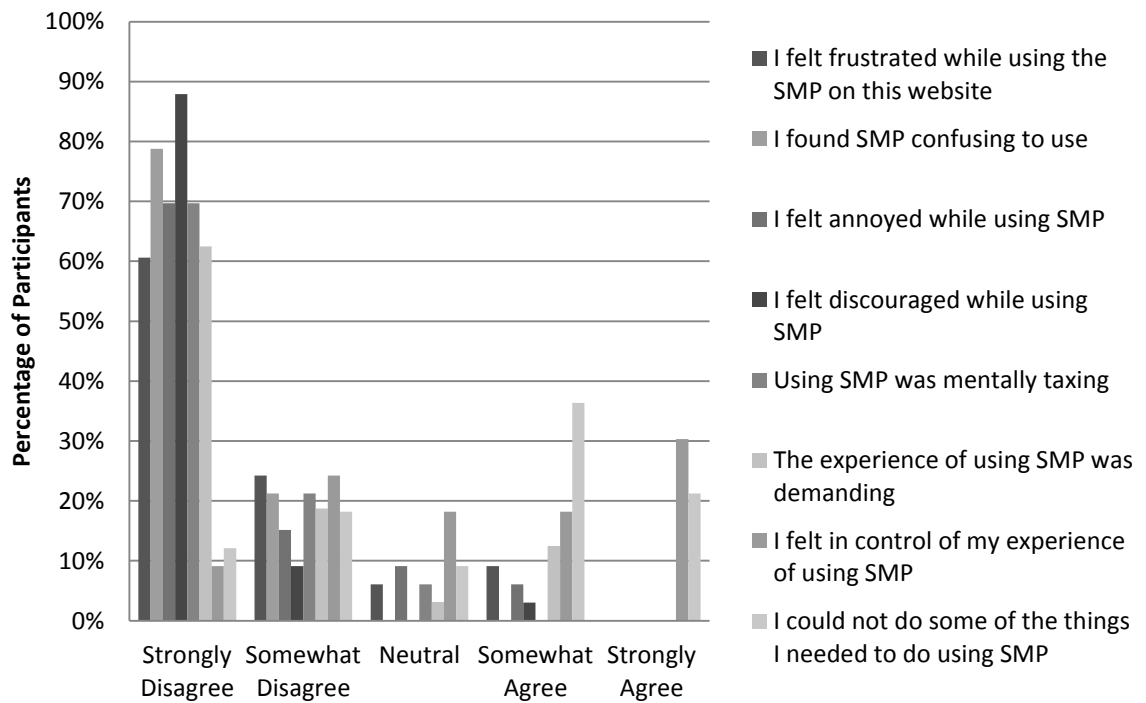
### **SMP and other navigation tools**

Participants were also asked to rate their experience of using SMP compared to other navigation tools (such as menus, search, links within the web page and browser tools). Majority of the participants (85%, 29/34) agreed that they found SMP to be useful for finding information on the website, compared to 82% (28/34) who found SMP to be useful for browsing the website. In comparison to menus, majority of the participants were in agreement (53%, 18/34) and neutral (32%, 12/34) to say that they preferred SMP over menus for fact finding tasks and similarly for browsing tasks (62% (21/34) agreed and 24% (8/34) were neutral). In comparison to search, majority of the participants were in agreement (61%, 21/34) to indicate that they preferred SMP over search for fact finding tasks and similarly for browsing tasks (73% (25/34)). In comparison to browser tools, some of the participants were in agreement (55%, 19/34) and neutral (21%, 7/34) to indicate that they preferred SMP over browser tools for fact finding tasks. For browsing tasks, majority (62% (21/34)) agreed that they preferred SMP over browser tools. In comparison to links within the web pages, majority of the participants (62%, 21/34) preferred SMP over links for fact finding tasks. However, for browsing tasks only 53% (18/34) agreed and 29% (10/34) disagreed that they preferred SMP over links. Therefore, in general SMP was preferred more for browsing tasks in comparison with menus, search and browser tools. Appendix 6.L illustrates the data in detail.

### **SMP and user engagement**

In order to measure and evaluate user engagement for SMP, we used multidimensional scale developed by O'Brien (2010) where they identify six attributes of user engagement: perceived usability, aesthetics, focused attention, felt involvement, novelty, and durability. Even though the intent of their multidimensional scale is to test user engagement of software applications, we decided to use three attributes to measure user engagement of SMP, namely perceived usability, aesthetics and novelty. Figure 6.22 (a) and Figure 6.22 (b) shows the three graphs illustrating these attributes.

## Perceived Usability



## Aesthetics

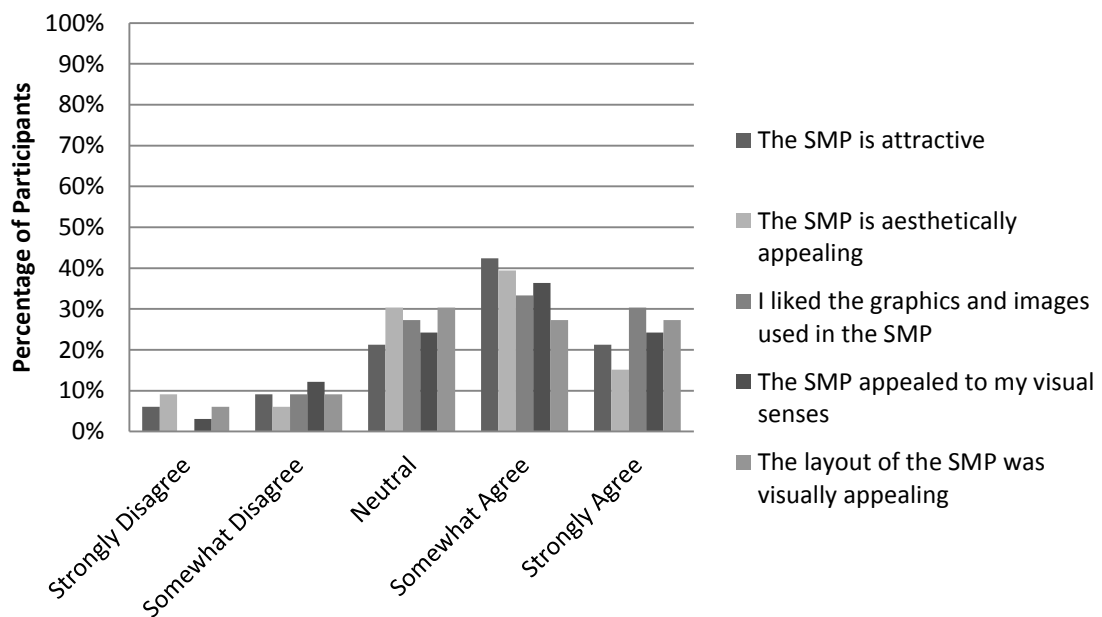


Figure 6.24 (a) – Perceived usability, aesthetics and novelty

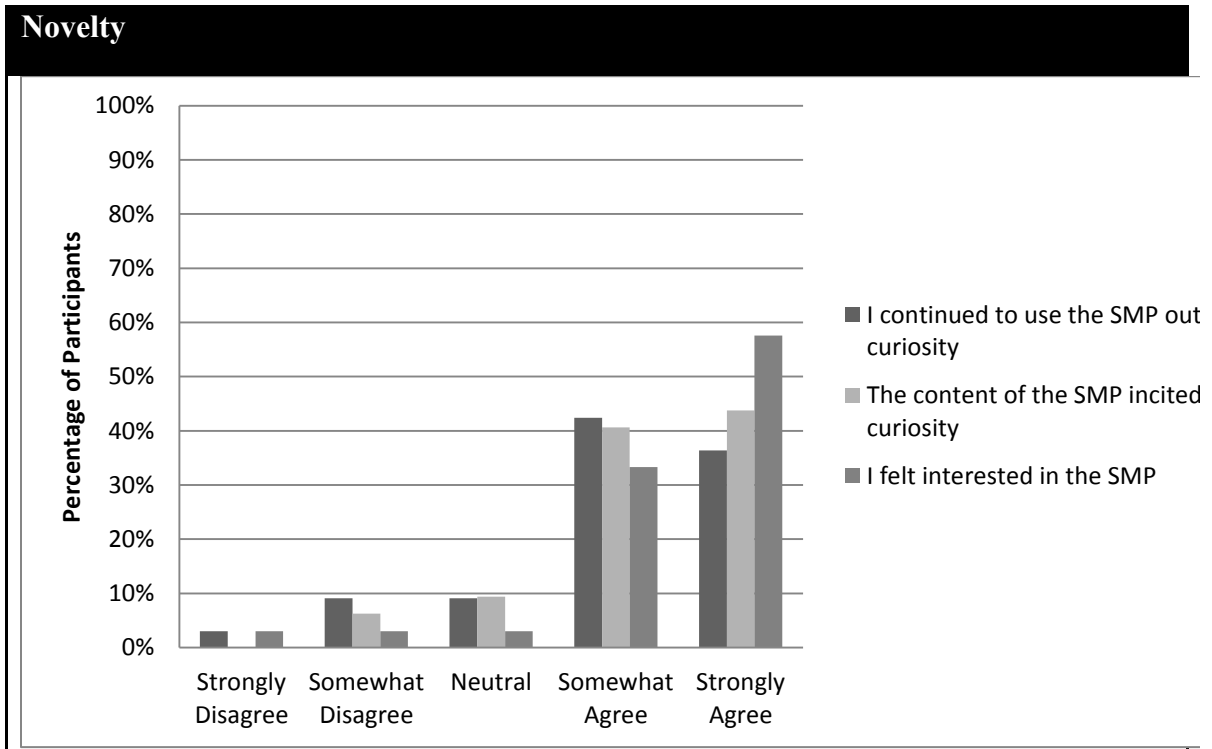


Figure 6.25 (b) – Perceived usability, aesthetics and novelty

To measure the attribute of perceived usability, participants were asked to rate a series of negative statements (i.e., “I felt frustrated while using the SMP”, “I found SMP confusing to use”, etc.). A total of eight statements were used to measure perceived usability. More than 50% of the participants either strongly disagreed or somewhat disagreed to the negative statements, which means that SMP was perceived to be user friendly by majority of the participants. However, participants somewhat and strongly agreed to the statement “I could not do some of the things I needed to do with SMP”. From the interview responses, it was gathered that this may be because participants were not able to search within SMP (i.e., filter web pages based on a keyword search) and they did not feel that it would be useful for fact finding tasks and hence limiting.

To measure the attribute of aesthetics, corresponding to the visual appeal of SMP, participants were asked to rate a series of positive statements (i.e., “The SMP was aesthetically appealing”, “The SMP was attractive”, etc.). A total of five statements were



used to measure aesthetics of SMP. Participants responses ranged from strongly agree to strongly disagree. In other words, participants did not find SMP to be visually appealing.

To measure the attribute of novelty, participants were asked to rate a series of positive statements (i.e., “I continued to use SMP out of curiosity”, “I felt interested in SMP”, etc.). A total of three statements were used to measure novelty. Majority of the participants either somewhat agreed or strongly agreed to the statements, indicating that participants found SMP to be novel.

### **SMP – Features Liked and Disliked**

More than 44% of the participants strongly agreed that they liked all the features of the SMP, as shown in Figure 6.23. Furthermore, participants responded to an optional open-ended question to elaborate on their response to what they liked about SMP. A total of 32% (11/34) of the participants responded to this open-ended question. Using NVivo, we analyzed their responses by first coding them into common themes.

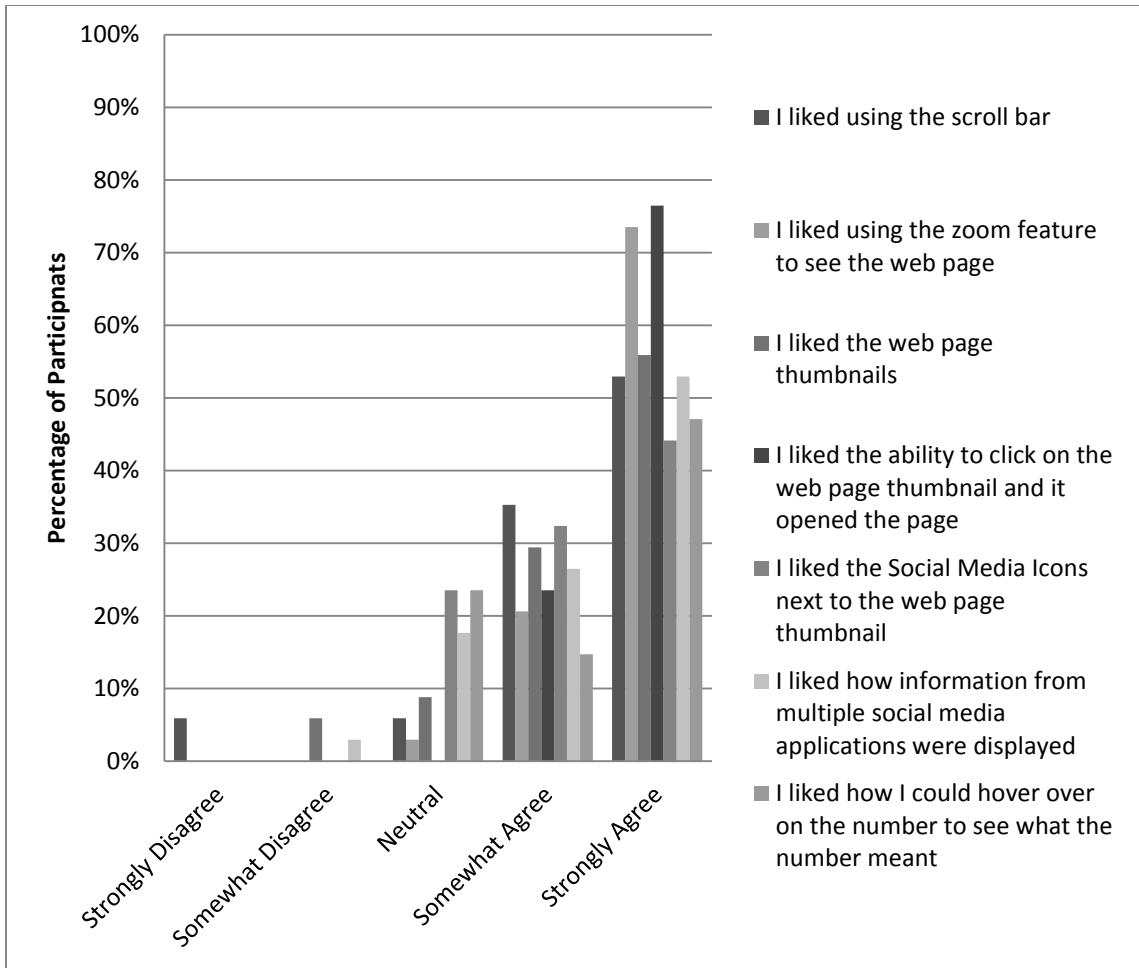


Figure 6.26 – SMP features liked

Some common themes emerged and included, SMP being beneficial for browsing tasks, the zoom/preview functionality allowed the ability to view information from two web pages all at once, and participants found SMP to be efficient in completing the task. The following describes what participants wrote in response to this question:

*“I see the benefit to the tool, and think that I would definitely use it for browsing when on such a site.” [P08]*

*“I found that the social media panel was a great idea to add onto the website because it allowed me to browse specific things more quickly as opposed to clicking on various links to get to my destination through the website itself.” [P31]*

Some participants (27% (3/11)) suggested improvements in response to this question. They included the following four:

1. Display only top 5 web pages instead of the top 20 that are part of SMP.
2. Include the capability to sort content by the number of posts and by the social media site.
3. Include the capability to search within the SMP.
4. Enable SMP to hide-in-or-out.

A total of 88% (30/34) of the participants responded to the open-ended question on what they disliked about SMP. Using NVivo, we analyzed their responses by first coding them into common themes. The following five categories emerged:

1. Visual appeal
2. Dependency on task, people and topic
3. Suggestions for improvements
4. Other (limited, does not reflect interest)
5. None (Did not dislike)

Participants (40%, 14/34) indicated that the SMP was not visually appealing. Multiple scroll bars (one for the web page, one for the browser and one for the SMP) was the top most disliked feature among the participants along with it using up space on a web page. Some of the quotes are as follows:

*“I like the ability to get an overview of a topic based on the popularity from online communities. I don't like that it takes up space on the side of the page while I am not necessarily using it.” [P02]*

*“I didn't like the look of it. It reminded me too much of the 90s with the use of frames and default scroll bars. It could definitely look more modern.” [P35]*

*“The graphics could be more appealing.” [P09]*

Participants (27%, 9/14) commented on its dependency on the type of task – browsing vs. fact finding. They indicated that the SMP would be useful if you are looking for topics that other people are referring to, but not if you are looking for specific information.

*“I found that the social media panel was only helpful if you were looking for specific information that happened to be available in the panel. If you were looking for a specific result for instance and that wasn't available on the panel you'd have to go back to browsing anyways.” [P37]*

*“Information was limited. It was good for finding specific details.” [P16]*

*“To find specific information that might not be popular, it would be difficult using this. The order of the pages was in order of Tweets, but in this case it might have been easier if they were in order of sports or grouped in different categories.” [P23]*

Some participants 13% (4/30) suggested improvements for the SMP. These were categorized into the following six categories.

1. **Search:** Ability to search within SMP.
2. **Disappearance of Preview on click:** The preview of the web page to disappear when the user clicks on the thumbnail image.
3. **Personalization:** Ability to choose which social media platform to display
4. **Page Revisitation:** Ability to display when the page has been clicked/visited (similar to how links behave when the user clicks on a link from Google search results).
5. **Organization:** Group by different categories (types of sports, etc.)
6. **Background Color:** Another background color for the SMP (not green)

Only three participants (10%, 3/30) indicated that they found SMP to be limiting and it did not reflect their interests. The remaining participants (10%, 3/30) indicated that they did not dislike anything about the SMP.

### **Types of websites**

Participants were asked to list the types of websites that they thought would benefit from SMP. All participants provided a response and their responses were categorized, as illustrated in Table 6.8 and Figure 6.24.

Table 6.8 – Types of websites useful for SMP

<b>Types of Websites</b>	<b>Number of Participants (N) out of 34 Total Participants</b>	<b>Percentage (%)</b>
<b>News</b>	15	44%
<b>Sports</b>	10	29%
<b>Blogs</b>	10	29%
<b>Shopping/ecommerce</b>	6	18%
<b>Gossip/Entertainment</b>	5	15%
<b>Academic/Education</b>	3	9%
<b>Reddit</b>	2	6%
<b>Company Website</b>	2	6%
<b>Government Websites</b>	2	6%
<b>TV Channels</b>	2	6%
<b>YouTube</b>	2	6%
<b>Bank</b>	1	3%
<b>Conference Website</b>	1	3%
<b>Social Media Sites</b>	1	3%
<b>Stock Trading</b>	1	3%

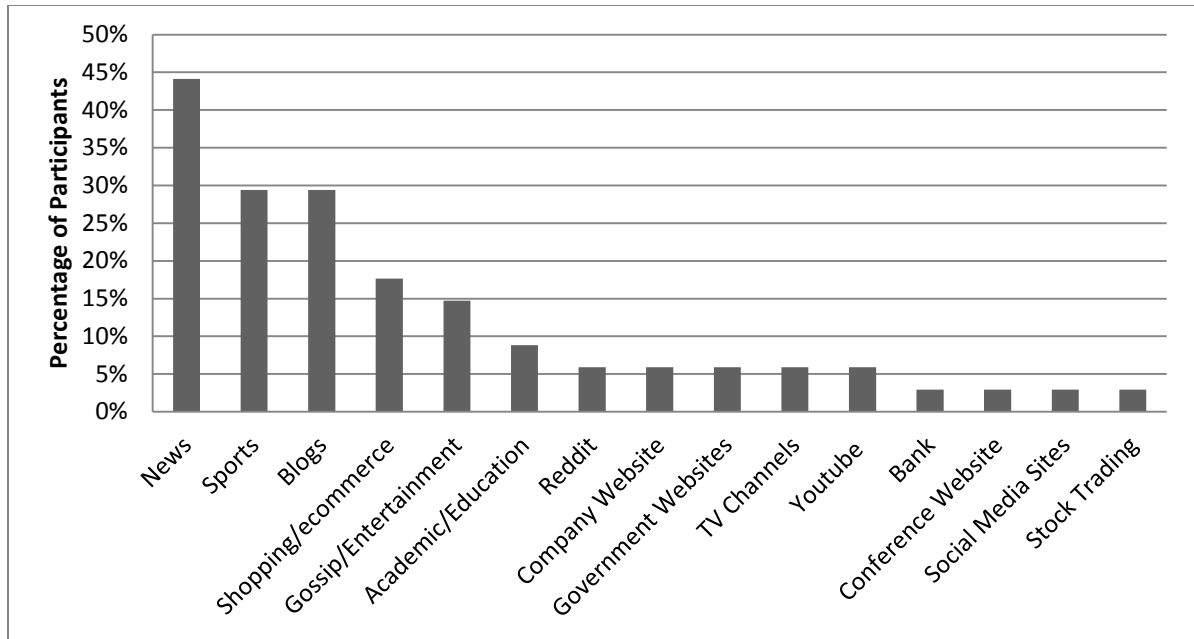


Figure 6.27 – Types of websites useful for SMP

Majority of the participants (44%, 15/34) indicated that SMP would be useful for news websites, followed by 29% (10/34) who indicated it would be useful for sports related websites and blogs. The rest included shopping, entertainment, academic, Reddit, companies, government, TV, YouTube, banks, conference, social media sites and stock trading sites. In addition, 18% (6/34) of the participants indicated that the SMP would be useful for any large websites and/or frequently updated websites. One participant indicated that it would also be useful for any website which attracts social media traffic.

### **Comments and Suggestions**

A total of 35% (12/34) of the participants responded to the last open-ended question indicating their comments and/or suggestions. Half of these participants (6/12) indicated that they found the SMP to be a great idea and had fun doing the tasks. They also found it to be efficient. The remaining participants suggested improving the visual and aesthetic appeal of the SMP, making the color inside SMP to match the colors of the website, and the ability to have the SMP slide in-and-out.

### *c. Data from Semi-Structured Interviews*

Participants were asked eleven questions during the interview session. The audio of interview responses were recorded, transcribed manually in Microsoft Excel and imported in NVivo for coding.

#### **Question 1: Which navigation tools do you use when you navigate websites to find specific information? and why?**

A total of 35% (12/34) of the participants indicated that they use search to find specific information on websites. They indicated that search is easy to find on websites, helps find relevant information efficiently and is easy to use. Out of these participants, some indicated that they prefer the flexibility of using their own search keywords and retrieving specific information easily. A total of 24% (8/34) of the participants indicated they use menus to find specific information on websites. They indicated that menus presents information in a categorized and organized fashion, is easy to find and is easy to use. Also participants indicated that they prefer using menus if they are familiar with the website and search if they are not familiar with the website. Only 12% (4/34) of the participants indicated they use menus along with links to find specific information and 12% (4/34) of the participants indicated they use menus, links and search to find specific information on websites. Only one participant indicated that they only use links and only one participant indicated that they only use browser tools to find specific information on websites. Both found these to be efficient and provided quick access to information. The results are shown in Table 6.9 and illustrated in Figure 6.25.

Table 6.9 – Navigation tools used for finding specific information on websites

Navigation tools used	Number of Participants	Percentage
Menus	8	24%
Search	12	35%
Links	1	3%
Browser Tools	1	3%
Links & Search	1	3%
Menus & Links	4	12%
Menus & Search	3	9%
Menus, Links, Search	4	12%
<b>Total</b>	<b>34</b>	<b>100%</b>

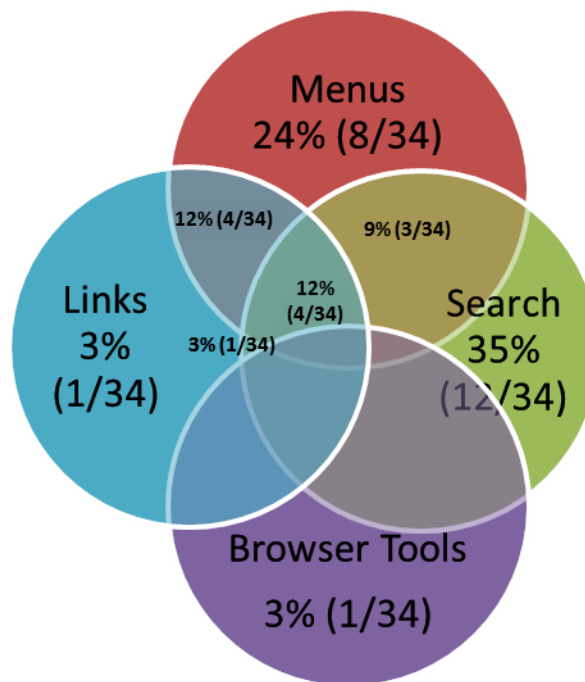


Figure 6.28 – Navigation tools used for finding specific information within websites

**Question 2: Which navigation tools do you use when you navigate websites to just browse? And why?**

A total of 44% (15/34) of the participants indicated that they use links to browse websites. They indicated that links included on the home page featuring news, videos, content of the website are the most efficient, easiest and provides a good summary to



assist with browsing a website. Some participants (35%, 12/34), indicated that they use menus for browsing websites. Some of the reasons included that it is easy to find and provides an overview of what is included on the website in an organized and categorized manner. Five participants indicated that they would use menus along with links to browse websites and two participants indicated that they would use links along with browser tools. . The results are shown in Table 6.10 and illustrated in Figure 6.26.

Table 6.10 – Navigation tools used for browsing within websites

<b>Navigation tools used</b>	<b>Number of Participants</b>	<b>Percentage</b>
<b>Menus</b>	12	35%
<b>Search</b>	0	0%
<b>Links</b>	15	44%
<b>Browser Tools</b>	0	0%
<b>Links &amp; Search</b>	0	0%
<b>Menus &amp; Links</b>	5	15%
<b>Menus &amp; Search</b>	0	0%
<b>Menus, Links, Search</b>	0	0%
<b>Links &amp; Browser Tools</b>	2	6%
<b>Total</b>	34	100%

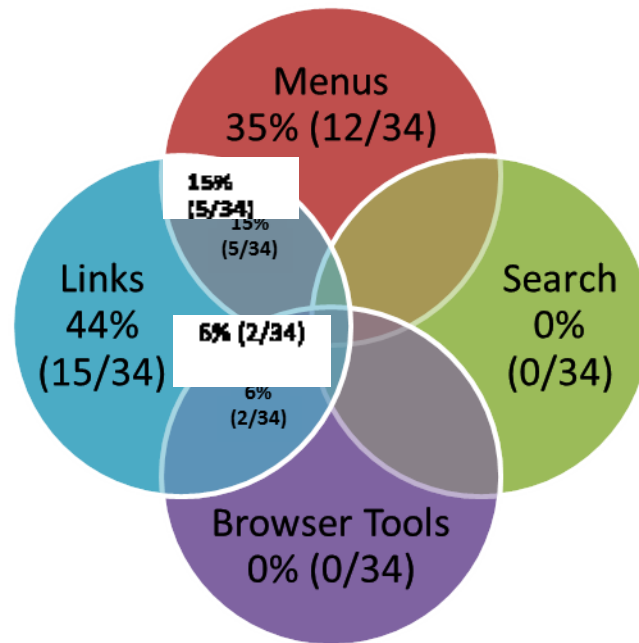


Figure 6.29 – Navigation tools used for browsing websites

**Question 3: What steps did you take when working with this task – please walk through your approach.**

The purpose of this question was to further understand participants actions based on observing their behavior during the task. Some participants used multiple navigation tools (such as links, SMP and search) and upon seeking further clarification it was discovered that this is how they typically browse websites. One participant opened new tabs and used search to complete one of the tasks. He mentioned that he always opens links on new tabs. Some participants read the home page to find information, which is normally what they do when they visit websites for just browsing.

It was also interesting to observe and learn that for some participants, their browsing task turned into a specific information gathering task during the study.

*“I recognized player Yuzuru Hanyū [Japanese figure skater], and wanted to see the information on the character. I wanted to see his achievements. Going from browsing, went to specific.” [P22]*

Most of the participants used SMP first for their last task (Task 5) and below are the reasons why:

*“The reason I first looked at Social Media Panel is because I think it is useful because it kind of acted as a filter as it extracted the most valuable information on the website. Then the task required me to find something I didn't know so the results in the panel are mostly of a particular game. I found it not so interesting so I went to other ways to search for information. If there is news that interests me, I might have used it as well.” [P12]*

*“I noticed that for the last task (Task 5), you used all the navigation tools, can you please explain the approach you followed to complete this task.” [Researcher]*

*“I was looking for something interesting. I clicked on the news and I didn't see too much. I then started to go through the whole site. Hovered over the Social Media Panel and found it useful for finding specific information but didn't find it useful for articles. I was looking for articles for something interesting.” [P16]*

*“I found this tool helped me to have a general idea to what is popular among people.” [P36]*

Also some participants clicked on the links inside the zoomed page while performing the task. When asked, they thought the entire zoomed page (which appears on hover) was interactive. This feature was not part of the prototype but a potential improvement to the SMP.

#### **Question 4: What features of the Social Media Panel did you like?**

A total of 76% (26/34) of the participants indicated that they liked the hover zoom functionality of the SMP, also referred to as preview of the web page feature, and found it to be efficient. Participants found that it saved time, number of clicks and provided them with an instant preview of the web page along with direct access to the web page. They also found it useful for making comparisons.

The second most liked feature was the number next to the web page thumbnails corresponding to the number of times the web page had been shared on the social media site. They indicated that it allowed them to distinguish the popularity of the web page. The third most liked feature included the order/ranking from highest to lowest and also the different social media applications represented therein (i.e., Facebook, Twitter, Google+ and LinkedIn).

**Question 5: What features of the Social Media Panel did you dislike?**

The majority of the participants (35%, 12/34) indicated that they did not like the visual appeal of the SMP. This included the background color of the panel (green) which they also stated may clash with certain websites.

A total of 15% (5/34) of the participants indicated that they found the SMP to be limiting since it did not include everything on the website, whereas a menu organizes all content into categories. The next most disliked feature included the real-estate, as SMP takes space on a web page and participants felt strongly that they needed the ability to hide SMP. Some of the other dislikes included: not being able to search from within the panel, the number of web page thumbnails, the multiple scroll bars, and the title being too small and tiresome to read. In addition, participants disliked that they could not tell which web pages had been visited by them before.

**Question 6: What improvements would you suggest to the Social Media Panel?**

In relation to question 5, where majority of the participants indicated that they did not like the visual appeal of the SMP, several responses to this question included suggested improvements. These improvements included changing the background color to match the color of the website and the need for padding to make the SMP look more modern. The second most suggested improvement was the ability to personalize the information displayed in SMP based on user's preferences and interests. This included ability to select

the social media applications to include/exclude and the ability to select the ordering of how to display the information. The third most suggested improvement included, the ability to drill into the SMP and read the tweets/messages that incorporate the link (i.e., read the context around in which the web page is shared) and the ability to share on social media from within the SMP.

The other suggested improvements included the ability to hide the SMP, the ability to search within the SMP, the ability to click from the zoom/preview feature of the page and the ability to distinguish between already visited web pages from those that have not been visited.

**Question 7: What kind of website would benefit from a Social Media Panel and why?**

A total of 56% (19/34) of the participants mentioned that they perceive the benefit of SMP on news related websites along with other websites. Some of the other websites included sports, blogs (such as TechCrunch), shopping (e.g., kijiji, amazon, ebay), feed based websites (such as Reddit, YouTube), websites with a large volume of information (such as government and university websites) and one participant mentioned that this could work for any website.

**Question 8: Do you think Social Media Panel would be useful when you visit websites with a specific goal of finding information and why?**

A total of 59% of the participants (20/34) said that they do not think that the SMP would be useful when you visit websites to find specific information, unless the specific information is already trending. Twenty-six percent of the participants (9/34) said that they do think it would be useful if the goal is popular too and if there was a way to search within the SMP. Fifteen percent of the participants (5/34) said that it would depend on the website and on the information seeking goal.

**Question 9: Do you think Social Media Panel would be useful when you visit websites to just browse and why?**

A total of 94% of the participants (32/34) said that they do think that the SMP would be useful when you visit websites to just browse. This is because when someone is browsing, they are looking for popular information and the SMP provided quick access to information that is popular and perhaps interesting. Only two participants said that the usefulness would depend since there may already be similar things on the websites and also a user's personal preference maybe to not rely on popular content.

**Question 10: Do you think there is value in knowing what are the popular pages on a website based on links shared on social media and why?**

Majority of the participants (82%, 28/34) said that they do think there is value in knowing what the popular pages are on a website based on links shared on social media. One of the common reasons was that SMP made it easier for them to find popular information faster.

*“Yes, because there is too much information. Human brain can't process everything. We have information more than we need. We need efficient way to tell us what is most important, what is most popular. Perhaps the downside is make the information more polarized (popular information will remain popular and what is ignored will remain ignored).” [P12]*

Participants also mentioned that web designers may find SMP useful to discover pages that are trending on a website. Some participants said that it would depend on the website, on the social media used, on the goal and also indicated that there is a potential for sabotage if someone hacks and tries to get the web pages ranked higher than the other web pages.

**Question 11: Do you have any comments, suggestions, or questions related to this study?**

A total of 21 participants responded to this last question of the interview. Out of which, 43% (9/34) of the participants thought SMP was a useful navigation tool. Some participants also indicated that adding features like the ability to have SMP slide in-and-out, real-time update of the numbers, integration with menu and search, and incorporating it as a browser plug-in could enhance the overall appeal and usability of the SMP.

**6.3.5.2 Quantitative Results**

Quantitative data was collected from the participants on-screen activity using Morae, namely the time, the number of clicks and the number of clicks for each navigation tool used to complete the tasks. The data is described in detail in Appendix 6.M, and the analysis is described in this section. SPSS was used to analyze all quantitative data.

**a. Time/Speed Analysis**

Firstly, the time to complete the task (i.e., latency) was converted into speed (how fast they completed the task which is a reciprocal of latency). Secondly, the z-scores were used to determine if there are any outliers in the data set. Thirdly, t-tests were used to determine whether there is any statistically significant difference in the means between the two tasks (task 1 and task 2). We found no statistical significance and therefore, the two tasks were combined to give power. Lastly, a 2-way ANOVA test was used to determine whether there is any statistically significant difference between the treatment (without SMP vs. with SMP), type of tasks (fact finding vs. browsing) and interaction between treatment and the type of tasks. The analysis design tree is illustrated in Figure 6.27.

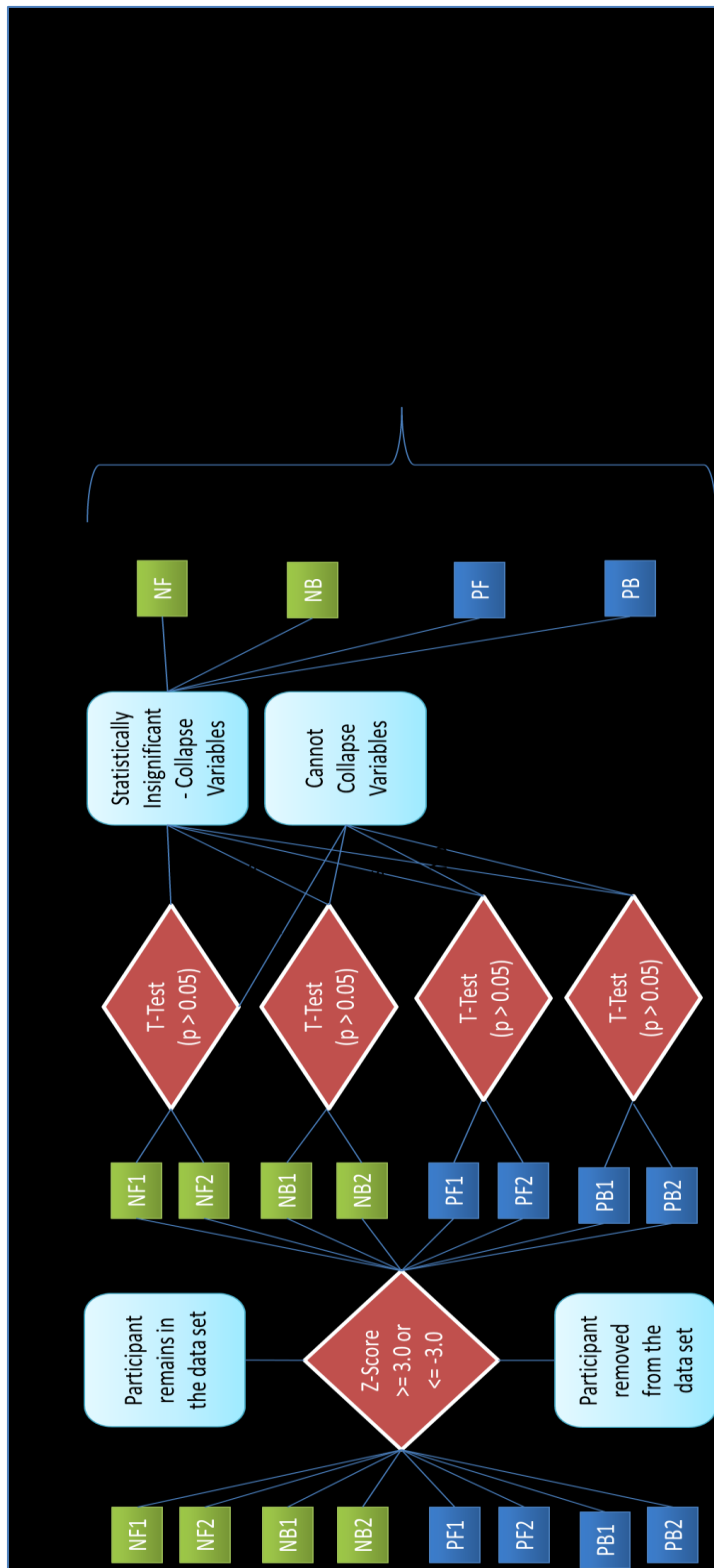


Figure 6.30 – Design tree for time/speed analysis



Based on the study design the following data points were collected, as shown in Table 6.11:

Table 6.11 - Data points in each data set

	<b>Fact finding (F)</b>	<b>Browsing (B)</b>
<b>Without SMP (N)</b>	$F1(17) + F2(17) = 34$	$B1(17) + B2(17) = 34$
<b>With SMP (P)</b>	$F1(17) + F2(17) = 34$	$B1(17) + B2(17) = 34$

### 1. Outlier Detection

The z-scores were used to determine potential outliers. The z-scores and the descriptive statistics for each data set are shown in Appendix 6.M. A z-score of greater than or equal to 3.0 or less than or equal to -3.0 (i.e., 3 standard deviation from the mean) was considered to be an outlier and was removed from the rest of the speed analysis. A total of three outliers were discovered: in the browsing task 2 (NB2) dataset without SMP (P02 with a z-score of 3.2154), in the browsing task 1 (PB1) dataset with SMP (P12 with a z-score of 3.62390), and in the browsing task 2 (PB2) dataset with SMP (P22 with a z-score of 3.79980). Participant P02, P12 and P22 were removed from the rest of the speed analysis, leaving NB2, PB1 and PB2 with 16 data points instead of 17, as shown in Table 6.12.

Table 6.12 - Data points in each data set after outliers were removed

	<b>Fact finding (F)</b>	<b>Browsing (B)</b>
<b>Without SMP (N)</b>	$F1(17) + F2(17) = 34$	$B1(17) + B2(16) = 33$
<b>With SMP (P)</b>	$F1(17) + F2(17) = 34$	$B1(16) + B2(16) = 32$

## 2. Collapsing Variables:

In order to collapse the two fact finding tasks and the two browsing tasks for each of the conditions (without SMP and with SMP), we had to ensure that they were statistically insignificant. Using SPSS, we used independent sample t-test to determine if the data sets: NF1 and NF2, NB1 and NB2, PF1 and PF2 and PB1 and PB2 could be combined. Table 6.13 shows the descriptive statistics of each data set and Table 6.14 displays the independent sample t-test results for each data set.

Table 6.13 – Descriptive statistics of each data set

Condition	Task	N	Mean	Std. Deviation	Std. Error Mean
Without SMP	NF1 (Fact Finding Task 1)	17	0.0251	0.0116	0.00281
	NF2 (Fact Finding Task 2)	17	0.035	0.02475	0.006
	NB1 (Browsing Task 1)	17	0.0070358	0.005169138	0.0012537
	NB2 (Browsing Task 2)	16	0.0046426	0.001632025	0.000408006
With SMP	PF1 (Fact Finding Task 1)	17	0.0352	0.02314	0.00561
	PF2 (Fact Finding Task 2)	17	0.0481	0.03816	0.00925
	PB1 (Browsing Task 1)	16	0.0055062	0.002136563	0.000534141
	PB2 (Browsing Task 2)	16	0.0061016	0.002279319	0.00056983

Table 6.14 – Independent sample t-test results

Without SMP - Fact Finding Task 1 & 2

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Speed	Equal variances assumed	16.135	0	-1.493	32	0.145	-0.0099	0.00663	-0.0234	0.0036
	Equal variances not assumed			-1.493	22.708	<b>0.149</b>	-0.0099	0.00663	-0.02362	0.00382

Without SMP – Browsing Task 1 & 2

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Speed	Equal variances assumed	7.054	0.012	1.769	31	0.087	0.0023932	0.0013526	-0.0003654	0.0051519
	Equal variances not assumed			1.815	19.337	<b>0.085</b>	0.0023932	0.0013184	-0.000363	0.0051494

With SMP - Fact Finding Task 1 & 2

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Speed	Equal variances assumed	5.311	0.028	-1.189	32	0.243	-0.01287	0.01082	-0.03491	0.00918
	Equal variances not assumed			-1.189	26.37	<b>0.245</b>	-0.01287	0.01082	-0.0351	0.00937

With SMP – Browsing Task 1 & 2

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Speed	Equal variances assumed	0.286	0.597	-0.762	30	0.452	-0.0005954	0.000781	-0.0021904	0.0009997
	Equal variances not assumed			-0.762	29.875	<b>0.452</b>	-0.0005954	0.000781	-0.0021907	0.001

For all the four conditions and data sets, the 2-tailed independent sample t-test significance is greater than 0.05 (**0.149, 0.085, 0.245 and 0.452**), we conclude that the difference between the speed in which the two tasks were completed (fact finding task 1 and fact- finding task 2, browsing task 1 and browsing task 2) without the SMP and with the SMP are statistically not significant. Therefore, the data sets (NF1 and NF2, NB1 and NB2, PF1 and PF2 and PB1 and PB2) were combined.

### **3. 2-Way ANOVA to test Interactions between Tasks and Conditions**

After removing all the outliers and organizing data into one row per participant, as shown in Appendix 6.N, SPSS was used to perform the 2-way ANOVA. The descriptive statistics and the results of the tests are described in Table 6.15 and Table 6.16.

Table 6.15 – Descriptive statistics

Descriptive Statistics								
	N	Minimum	Maximum	Mean	Std. Deviation	Variance	Skewness	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
NF	31	.002778	.076923	.03037116	.020157352	.000	.739	.421
NB	31	.002681	.021277	.00588935	.004111959	.000	2.654	.421
PF	31	.010526	.125000	.03760366	.029374975	.001	1.892	.421
PB	31	.002381	.011111	.00577606	.002224636	.000	.571	.421
Valid N (listwise)	31							

Table 6.16 – Multivariate test – ANOVA for the tasks and conditions

Multivariate Tests

Effect		Value	F	Hypothesis df	Error df	Sig.
NvsP	Pillai's Trace	.043	1.346 <sup>b</sup>	1.000	30.000	.255
	Wilks' Lambda	.957	1.346 <sup>b</sup>	1.000	30.000	.255
	Hotelling's Trace	.045	1.346 <sup>b</sup>	1.000	30.000	.255
	Roy's Largest Root	.045	1.346 <sup>b</sup>	1.000	30.000	.255
FvsB	Pillai's Trace	.720	77.190 <sup>b</sup>	1.000	30.000	<b>.000</b>
	Wilks' Lambda	.280	77.190 <sup>b</sup>	1.000	30.000	<b>.000</b>
	Hotelling's Trace	2.573	77.190 <sup>b</sup>	1.000	30.000	<b>.000</b>
	Roy's Largest Root	2.573	77.190 <sup>b</sup>	1.000	30.000	<b>.000</b>
NvsP *	Pillai's Trace	.040	1.237 <sup>b</sup>	1.000	30.000	.275
FvsB	Wilks' Lambda	.960	1.237 <sup>b</sup>	1.000	30.000	.275
	Hotelling's Trace	.041	1.237 <sup>b</sup>	1.000	30.000	.275
	Roy's Largest Root	.041	1.237 <sup>b</sup>	1.000	30.000	.275

The two-way ANOVA repeated measures results allow us to conclude that there is a main effect on the speed in which these tasks were completed when the task was either fact finding or browsing. The p-value, given in the “sig” column, 0.00 is less than 0.05 for the type of task. From the means of the two tasks measured in speed, where the larger the

number the faster the performance, we conclude that it was faster to complete the fact finding task, defined as 1 in the Table 6.17.

Table 6.17 – Descriptive statistics for the two tasks (fact finding vs. browsing)

FvsS	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
1	.034	.003	.027	.041
2	.006	.000	.005	.007

The results allow us to conclude that SMP did not cause any effect since the significance was 0.255 which is greater than 0.05. Furthermore, there is no significant interaction between the two conditions (with SMP and without SMP) and between the two types of tasks (fact finding and browsing) since the p-value 0.275 is greater than 0.05. A graph illustration showing that there is no interaction is shown in Figure 6.28.

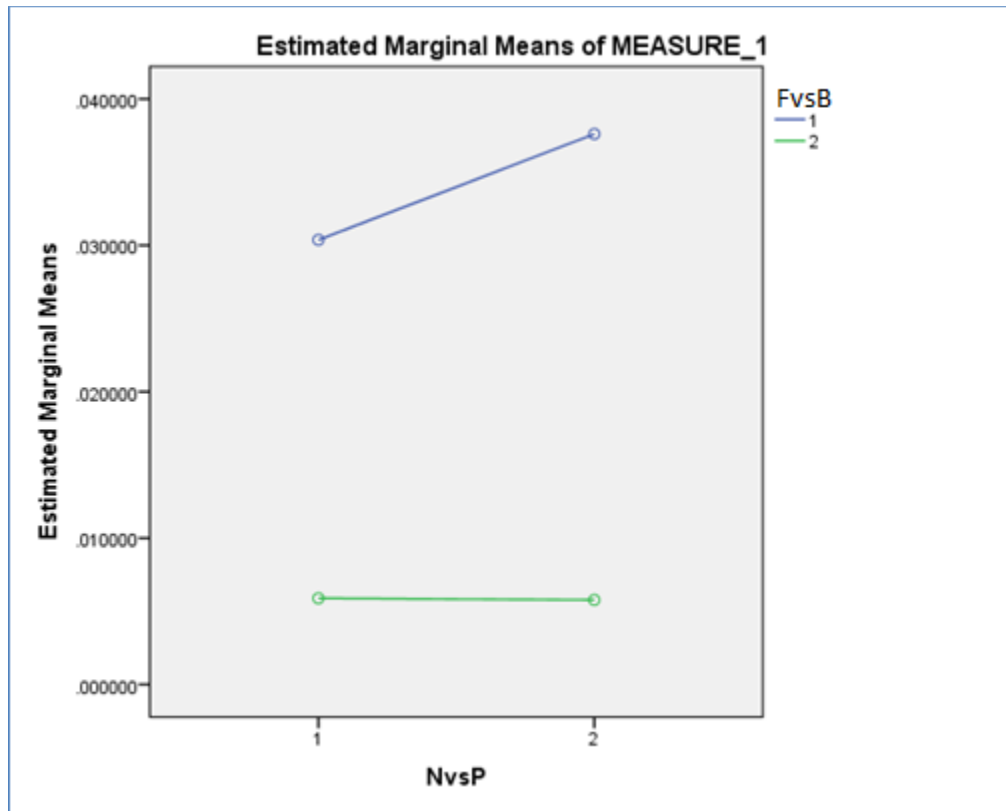


Figure 6.31 – Interaction graph from 2-way ANOVA results

The above analysis was also repeated for latency (time to complete the task). All analysis shows that there was a statistical significance between the types of tasks (fact finding and browsing) and no statistical significance in the two conditions (with SMP and without SMP) and no statistical significance between the conditions and the tasks combined.

### *b. Click Analysis*

We conducted two types of analysis: one where we considered the total number of clicks and the other where we considered total number of clicks for each navigation tool (i.e., menu, search, links within the web pages, browser tools and SMP).

#### **Total Number of Clicks**

Firstly, we investigated if there were any outliers in each of the data sets. We looked at the cumulative number of clicks used to complete each task and determined outliers using z-score analysis. Secondly, t-tests were used to determine whether there is any statistically significant difference in the means between the two tasks (task 1 and task 2). We found no statistical significance and therefore, the two data sets for the tasks were combined to give power. Lastly, a 2-way ANOVA test was used to determine whether there are any statistically significant differences between the treatment (without SMP vs. with SMP), type of tasks (fact finding vs. browsing) and interaction between treatment and type of tasks. The analysis design tree is the same as the one illustrated in Figure 6.27.

Based on the study design the following data points were collected, as shown in Table 6.18:

Table 6.18 - Data points in each data set

	<b>Fact finding (F)</b>	<b>Browsing (B)</b>
<b>Without SMP (N)</b>	$F1(17) + F2(17) = 34$	$B1(17) + B2(17) = 34$
<b>With SMP (P)</b>	$F1(17) + F2(17) = 34$	$B1(17) + B2(17) = 34$

### 1. Outlier Detection

The z-scores were used to determine potential outliers. The z-scores along with the descriptive statistics for each data set are shown in Appendix 6.O. A z-score of greater than or equal to 3.0 or less than or equal to -3.0 (i.e., 3 standard deviation from the mean) was considered to be an outlier and was removed from the rest of the total number of clicks analysis. Only one outlier was found in the fact finding task 2 without SMP (NF2) dataset (P18 with a z-score of 3.60604). Participant P18 was removed leaving NF2 with 16 data points instead of 17, as shown in Table 6.19. In addition, the skewness of the data set is 3.247 which is considerably high. After the removal of participant P18, the skewness dropped to .836.

Table 6.19 - Data points in each data set after outliers were removed

	<b>Fact finding (F)</b>	<b>Browsing (B)</b>
<b>Without SMP (N)</b>	$F1(17) + F2(16) = 33$	$B1(17) + B2(17) = 34$
<b>With SMP (P)</b>	$F1(17) + F2(17) = 34$	$B1(17) + B2(17) = 34$



## 2. Collapsing Variables:

In order to collapse the two fact finding tasks and the two browsing tasks for each of the conditions (without SMP and with SMP), we had to ensure that they were statistically insignificant. Using SPSS, we used independent sample t-test to determine if the data sets: NF1 and NF2, NB1 and NB2, PF1 and PF2 and PB1 and PB2 could be combined. Table 6.20 shows the descriptive statistics of each data set and Table 6.21 displays the independent sample t-test results for each data set.

Table 6.20 – Descriptive statistics of each data set

Condition	Task	N	Mean	Std. Deviation	Std. Error Mean
Without SMP	NF1 (Fact Finding Task 1)	17	3.82	1.845	0.448
	NF2 (Fact Finding Task 2)	16	3.75	2.017	0.504
	NB1 (Browsing Task 1)	17	12.12	5.883	1.427
	NB2 (Browsing Task 2)	17	14.41	7.874	1.91
With SMP	PF1 (Fact Finding Task 1)	17	1.65	0.931	0.226
	PF2 (Fact Finding Task 2)	17	1.35	0.702	0.17
	PB1 (Browsing Task 1)	17	7.18	5.341	1.295
	PB2 (Browsing Task 2)	17	8.24	8.356	2.027

Table 6.21 – Independent sample t-test results

Without SMP - Fact Finding Task 1 & 2										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Number_of_Clicks	Equal variances assumed	0.534	0.47	0.109	31	0.914	0.074	0.672	-1.298	1.445
	Equal variances not assumed			0.109	30.309	<b>0.914</b>	0.074	0.674	-1.303	1.45
Without SMP - Browsing Task 1 & 2										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Number_of_Clicks	Equal variances assumed	0.321	0.575	-0.962	32	0.343	-2.294	2.384	-7.15	2.562
	Equal variances not assumed			-0.962	29.618	<b>0.344</b>	-2.294	2.384	-7.165	2.577
With SMP - Fact Finding Task 1 & 2										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Number_of_Clicks	Equal variances assumed	1.917	0.176	1.04	32	0.306	0.294	0.283	-0.282	0.87
	Equal variances not assumed			1.04	29.74	<b>0.307</b>	0.294	0.283	-0.284	0.872
With SMP - Browsing Task 1 & 2										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Number_of_Clicks	Equal variances assumed	0.707	0.407	-0.44	32	0.663	-1.059	2.405	-5.958	3.84
	Equal variances not assumed			-0.44	27.205	<b>0.663</b>	-1.059	2.405	-5.992	3.875

For all the four conditions and data sets, the 2-tailed independent sample t-test significance is greater than 0.05 (**0.914, 0.344, 0.307 and 0.663**), we conclude that the difference in the total number of clicks between the two tasks (fact finding task 1 and fact- finding task 2, browsing task 1 and browsing task 2) with and without the SMP are statistically not significant. Therefore, we can combine the data sets: NF1 and NF2, NB1 and NB2, PF1 and PF2 and PB1 and PB2.

### 3. 2-Way ANOVA to test Interactions between Tasks and Conditions

After removing all the outliers and organizing data into one row per participant, as shown in Appendix 6.P, SPSS was used to perform the 2-way ANOVA. The descriptive statistics and the results of the tests are described below.

Table 6.22 – Multivariate tests

Descriptive Statistics								
	N	Minimum	Maximum	Mean	Std. Deviation	Variance	Skewness	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
NF	33	2	8	3.79	1.900	3.610	.790	.409
NB	33	4	35	13.03	6.912	47.780	1.283	.409
PF	33	1	4	1.48	.834	.695	1.601	.409
PB	33	1	32	7.91	6.930	48.023	1.647	.409
Valid N (listwise)	33							

Table 6.23 – Descriptive statistics

Multivariate Tests <sup>a</sup>						
Effect		Value	F	Hypothesis df	Error df	Sig.
NvsP	Pillai's Trace	.395	20.892 <sup>b</sup>	1.000	32.000	.000
	Wilks' Lambda	.605	20.892 <sup>b</sup>	1.000	32.000	.000
	Hotelling's Trace	.653	20.892 <sup>b</sup>	1.000	32.000	.000
	Roy's Largest Root	.653	20.892 <sup>b</sup>	1.000	32.000	.000
FvsB	Pillai's Trace	.724	83.790 <sup>b</sup>	1.000	32.000	.000
	Wilks' Lambda	.276	83.790 <sup>b</sup>	1.000	32.000	.000
	Hotelling's Trace	2.618	83.790 <sup>b</sup>	1.000	32.000	.000
	Roy's Largest Root	2.618	83.790 <sup>b</sup>	1.000	32.000	.000
NvsP * FvsB	Pillai's Trace	.071	2.445 <sup>b</sup>	1.000	32.000	.128
	Wilks' Lambda	.929	2.445 <sup>b</sup>	1.000	32.000	.128
	Hotelling's Trace	.076	2.445 <sup>b</sup>	1.000	32.000	.128
	Roy's Largest Root	.076	2.445 <sup>b</sup>	1.000	32.000	.128

The two-way ANOVA repeated measures results allow us to conclude that there is a main effect on the number of clicks when the task was either fact finding or browsing. The p-value, given in the “sig” column, 0.00 is less than 0.05 for the type of task. From the means of the two tasks, we can determine that it took more clicks to complete the browsing task (defined as 2 in Table 6.24) than the fact finding tasks (defined as 1 in Table 6.24).

Table 6.24 – Descriptive statistics for the two tasks (fact finding vs. browsing)

FvsS	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
1	2.636	.176	2.278	2.994
2	10.470	.866	8.706	12.234

The results also allow us to conclude that there is a statistically significant difference in the number of clicks when participants performed the task with SMP and without SMP. The p-value of .000 is less than 0.05. It took less number of clicks to perform the task

with SMP than without the SMP, as we notice the mean of 4.697 for SMP (defined as 2 in Table 6.25).

Table 6.25 – Descriptive statistics

**2. NvsP**

Measure: MEASURE\_1

NvsP	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
1	8.409	.596	7.194	9.624
2	4.697	.623	3.427	5.967

The results allow us to conclude that there is no significant interaction between the two conditions (with SMP and without SMP) and between the two types of tasks (fact finding and browsing) since the p-value 0.128 is greater than 0.05. A graph illustration showing that there is no interaction is shown in Figure 6.29.

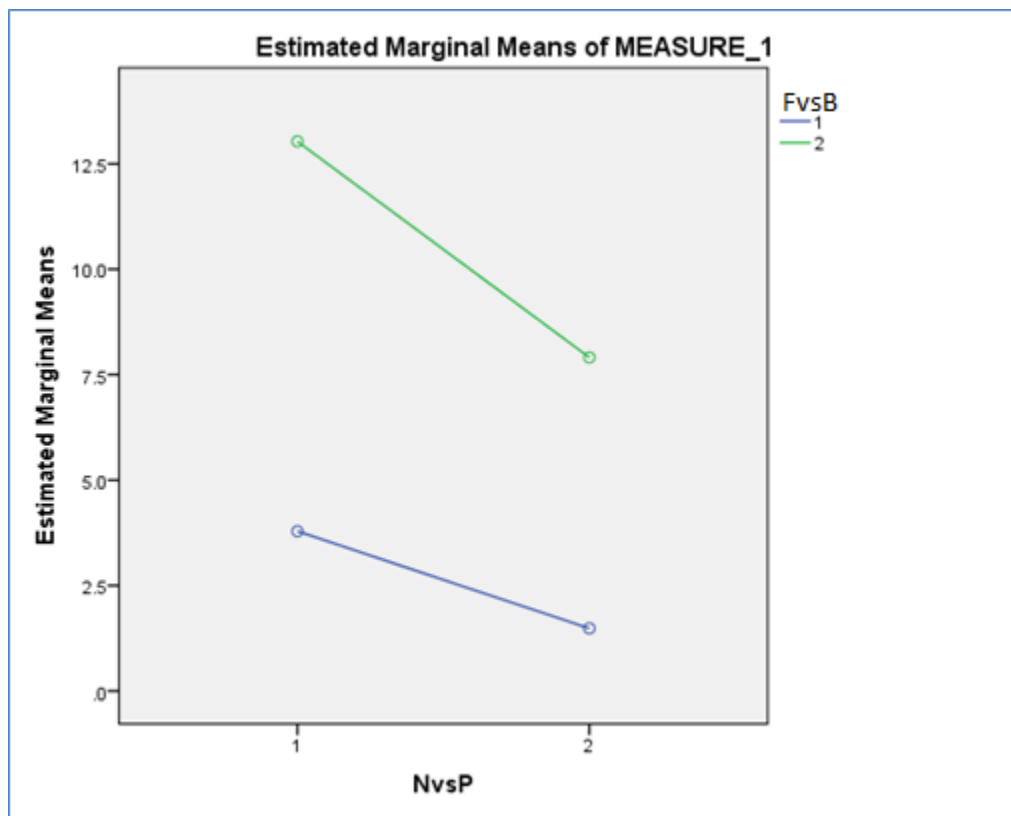


Figure 6.32 – Interaction graph from 2-way ANOVA results

**Total Number of Clicks by Navigation Tool**

Firstly, we investigated if there were any outliers in each of the data sets. We looked at the cumulative number of clicks for each of the navigation tool (menus, search, links, browser tools, SMP) and determined outliers using z-score analysis. Secondly, t-tests were used to determine whether there is any statistically significant difference in the means between the two tasks (task 1 and task 2). We found no statistical significance and therefore, the two data sets for the tasks were combined to give power. Lastly, a 2-way ANOVA test was used to determine whether there are any statistically significant differences between the treatment (without SMP vs. with SMP), type of tasks (fact finding vs. browsing) and interaction between treatment and type of tasks. The analysis design tree is illustrated in Figure 6.30. Descriptive statistics was used to explain the rest of the data sets. Based on the study design the following data points were collected, as shown in Table 6.26.

Table 6.26 - Data points in each data set

	<b>Fact finding (F)</b>	<b>Browsing (B)</b>
<b>Without SMP (N)</b>	$F1(17) + F2(17) = 34$	$B1(17) + B2(17) = 34$
<b>With SMP (P)</b>	$F1(17) + F2(17) = 34$	$B1(17) + B2(17) = 34$

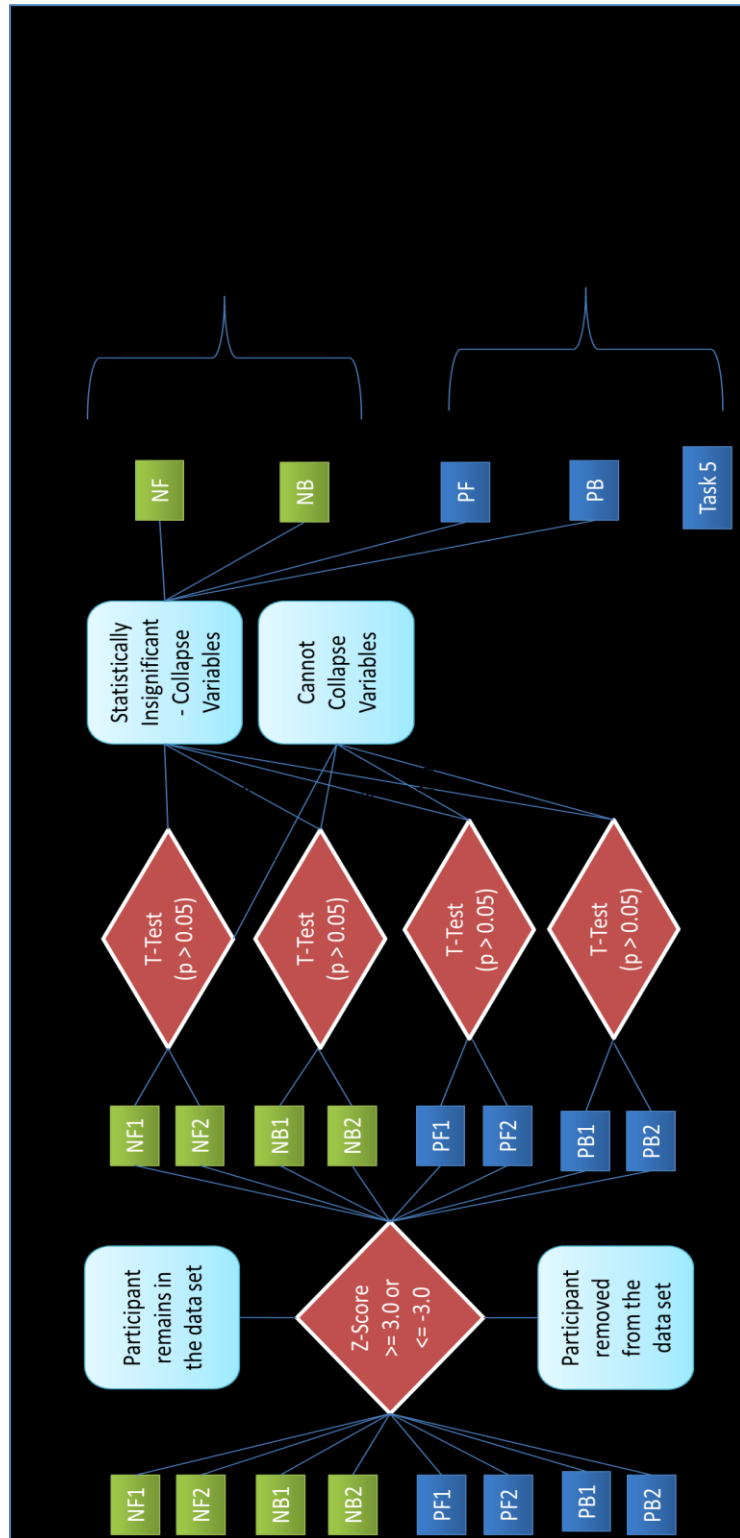


Figure 6.33 – Design tree for number of clicks analysis for each navigation tool

## 1. Outlier Detection

The z-scores were used to determine potential outliers. The z-scores along with the descriptive statistics for each data set are shown in Appendix 6.Q. A z-score of greater than or equal to 3.0 or less than or equal to -3.0 (i.e., 3 standard deviation from the mean) was considered to be an outlier and was removed from the rest of the clicks analysis. A total of nine outliers were found, as illustrated in Table 6.27. The data sets were reduced accordingly, as illustrated in Table 6.28.

Table 6.27 – Outliers in each treatment data set

Treatment	Participant IDs
NF1	P27
NF2	P18
NB1	-
NB2	P25
PF1	-
PF2	P04, P28
PB1	P13
PB2	P03, P08, P27

Table 6.28 - Data points in each data set after outliers were removed

	Fact finding (F)	Browsing (B)
<b>Without SMP (N)</b>	F1(16) + F2(16) = 32	B1(17) + B2(16) = 33
<b>With SMP (P)</b>	F1(17) + F2(15) = 32	B1(16) + B2(14) = 30



## 2. Collapsing Variables:

In order to collapse the two fact finding tasks and the two browsing tasks for each of the conditions (without SMP and with SMP), we had to ensure that they were statistically insignificant. Using SPSS, we used independent sample t-test to determine if the data sets: NF1 and NF2, NB1 and NB2, PF1 and PF2 and PB1 and PB2 could be combined. Table 6.29 shows the descriptive statistics of each data set and Table 6.30 displays the independent sample t-test results for each data set.

Table 6.29 – Descriptive statistics of each data set

Condition	Navigation Tools	Task	N	Mean	Std. Deviation	Std. Error Mean	
Without SMP	Menu	NF1	16	1.38	0.719	0.18	
		NF2	16	1.19	0.911	0.228	
	Search	NF1	16	0.38	0.619	0.155	
		NF2	16	0.44	0.892	0.223	
	Links	NF1	16	1.5	0.73	0.183	
		NF2	16	1.94	1.181	0.295	
	BrowserTools	NF1	16	0.44	0.727	0.182	
		NF2	16	0.19	0.403	0.101	
		Menu	NS1	17	5.29	3.46	0.839
			NS2	16	6.5	4.227	1.057
		Search	NS1	17	0.41	0.87	0.211
			NS2	16	0.25	0.447	0.112
Links		NS1	17	5.06	3.766	0.913	
		NS2	16	5.75	3.568	0.892	
BrowserTools	NS1	17	1.35	1.539	0.373		
	NS2	16	0.63	0.806	0.202		
With SMP	Menu	PF1	17	0.29	0.47	0.114	
		PF2	15	0.07	0.258	0.067	
	Search	PF1	17	0	.000 <sup>a</sup>	0	
		PF2	15	0	.000 <sup>a</sup>	0	
	Links	PF1	17	0	.000 <sup>a</sup>	0	
		PF2	15	0	.000 <sup>a</sup>	0	
	BrowserTools	PF1	17	0	.000 <sup>a</sup>	0	
		PF2	15	0	.000 <sup>a</sup>	0	
	SMP	PF1	17	1.35	0.702	0.17	
		PF2	15	1.07	0.258	0.067	
		Menu	PS1	16	1.44	2.032	0.508
			PS2	14	1	2.353	0.629
		Search	PS1	16	0	.000 <sup>a</sup>	0
			PS2	14	0	.000 <sup>a</sup>	0
		Links	PS1	16	1.88	2.419	0.605
			PS2	14	0.36	0.633	0.169
	BrowserTools	PS1	16	0.31	1.014	0.254	
		PS2	14	0.14	0.363	0.097	
SMP	PS1	16	3.88	3.117	0.779		
	PS2	14	4.21	3.118	0.833		

Table 6.30 (a) – Independent sample t-test results

Without SMP - Fact Finding Task 1 & 2

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Menu	Equal variances assumed	0.122	0.729	0.646	30	0.523	0.188	0.29	-0.405	0.78
	Equal variances not assumed			0.646	28.465	<b>0.523</b>	0.188	0.29	-0.406	0.781
Search	Equal variances assumed	0.725	0.401	-0.23	30	0.819	-0.063	0.271	-0.617	0.492
	Equal variances not assumed			-0.23	26.729	<b>0.82</b>	-0.063	0.271	-0.62	0.495
Links	Equal variances assumed	0.768	0.388	-1.26	30	0.217	-0.438	0.347	-1.147	0.272
	Equal variances not assumed			-1.26	25.002	<b>0.219</b>	-0.438	0.347	-1.153	0.278
Browser Tools	Equal variances assumed	6.824	0.014	1.202	30	0.239	0.25	0.208	-0.175	0.675
	Equal variances not assumed			1.202	23.419	<b>0.241</b>	0.25	0.208	-0.18	0.68

Table 6.31 (b) – Independent sample t-test results

Without SMP - Browsing Task 1 & 2

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Menu	Equal variances assumed	1.449	0.238	-0.899	31	0.375	-1.206	1.341	-3.941	1.529
	Equal variances not assumed			-0.894	29.052	<b>0.379</b>	-1.206	1.349	-3.965	1.554
Search	Equal variances assumed	2.707	0.11	0.665	31	0.511	0.162	0.243	-0.334	0.658
	Equal variances not assumed			0.677	24.206	<b>0.505</b>	0.162	0.239	-0.331	0.655
Links	Equal variances assumed	0.093	0.762	-0.54	31	0.593	-0.691	1.279	-3.3	1.917
	Equal variances not assumed			-0.541	30.998	<b>0.592</b>	-0.691	1.277	-3.295	1.913
Browser Tools	Equal variances assumed	4.256	0.048	1.686	31	0.102	0.728	0.432	-0.153	1.609
	Equal variances not assumed			1.716	24.474	<b>0.099</b>	0.728	0.424	-0.147	1.602

Table 6.32 (c) – Independent sample t-test results

With SMP - Fact Finding Task 1 & 2

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Menu	Equal variances assumed	15.555	0	1.665	30	0.106	0.227	0.137	-0.052	0.506
	Equal variances not assumed			1.723	25.428	<b>0.097</b>	0.227	0.132	-0.044	0.499
SMP	Equal variances assumed	11.361	0.002	1.491	30	0.146	0.286	0.192	-0.106	0.678
	Equal variances not assumed			1.566	20.727	<b>0.133</b>	0.286	0.183	-0.094	0.667

Table 6.33 (d) – Independent sample t-test results

With SMP - Browsing Task 1 & 2

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Menu	Equal variances assumed	0.825	0.372	0.547	28	0.589	0.438	0.8	-1.202	2.077
	Equal variances not assumed			0.541	25.93	<b>0.593</b>	0.438	0.809	-1.225	2.1
Links	Equal variances assumed	11.192	0.002	2.276	28	0.031	1.518	0.667	0.152	2.884
	Equal variances not assumed			2.417	17.32	<b>0.027</b>	1.518	0.628	0.195	2.841
BrowserTools	Equal variances assumed	1.654	0.209	0.592	28	0.558	0.17	0.286	-0.417	0.756
	Equal variances not assumed			0.625	19.239	<b>0.54</b>	0.17	0.272	-0.398	0.738
SMP	Equal variances assumed	0.134	0.717	-0.297	28	0.768	-0.339	1.141	-2.676	1.998
	Equal variances not assumed			-0.297	27.472	<b>0.768</b>	-0.339	1.141	-2.678	2

For all the four conditions and data sets, the 2-tailed independent sample t-test significance is greater than 0.05 for all the navigation tools, except for one navigation tool (links) for one of the data set (browsing task with SMP). The significance of 0.027 is less than 0.05. However, considering the other three navigation tools were greater than 0.05, we decided to continue with our analysis. We conclude that the difference in the number of clicks for each navigation tool between the two tasks (fact finding task 1 and fact- finding task 2, browsing task 1 and browsing task 2) with and without the SMP are statistically not significant. Therefore, the data sets (NF1 and NF2, NB1 and NB2, PF1 and PF2 and PB1 and PB2) were combined.

### 3. 2-Way ANOVA to test Interactions between Tasks and Conditions

We used SPSS to perform the 2-way ANOVA test. Based on the above analysis, all 8 outliers were removed from the study, leaving 26 participants in total for each data set, as shown in Table 6.31.

Table 6.34 – Data points after outliers are removed

	Menu	Search	Links	Browser Tools	SMP
<b>NF (without SMP, fact finding)</b>	26	26	26	26	-
<b>NB (without SMP, browsing)</b>	26	26	26	26	-
<b>PF (with SMP, fact finding)</b>	26	26	26	26	26
<b>PB (with SMP, browsing)</b>	26	26	26	26	26
<b>Task 5</b>	26	26	26	26	26

a. **Without SMP**

We performed a 2-way ANOVA repeated measure test for the first two conditions (NF and NS). This is because we do not have data under the SMP column and hence we cannot perform a full ANOVA on the entire dataset. The 2-way ANOVA test was conducted with the following two factors: one with 2 levels and the other with 4 levels:

1. Factor 1: fact finding, browsing (2 levels)
2. Factor 2: menu, search, links, browser tools (4 levels).

Table 6.32 shows that there is a statistically significant difference between the two types of tasks and the four navigation tools. In addition, there is interaction.

Table 6.35 – ANOVA on tasks and navigation tools

<b>Multivariate Tests<sup>a</sup></b>						
Effect		Value	F	Hypothesis df	Error df	Sig.
Tasks	Pillai's Trace	.685	54.465 <sup>b</sup>	1.000	25.000	.000
	Wilks' Lambda	.315	54.465 <sup>b</sup>	1.000	25.000	.000
	Hotelling's Trace	2.179	54.465 <sup>b</sup>	1.000	25.000	.000
	Roy's Largest Root	2.179	54.465 <sup>b</sup>	1.000	25.000	.000
NavTools	Pillai's Trace	.856	45.559 <sup>b</sup>	3.000	23.000	.000
	Wilks' Lambda	.144	45.559 <sup>b</sup>	3.000	23.000	.000
	Hotelling's Trace	5.942	45.559 <sup>b</sup>	3.000	23.000	.000
	Roy's Largest Root	5.942	45.559 <sup>b</sup>	3.000	23.000	.000
Tasks * NavTools	Pillai's Trace	.659	14.812 <sup>b</sup>	3.000	23.000	.000
	Wilks' Lambda	.341	14.812 <sup>b</sup>	3.000	23.000	.000
	Hotelling's Trace	1.932	14.812 <sup>b</sup>	3.000	23.000	.000
	Roy's Largest Root	1.932	14.812 <sup>b</sup>	3.000	23.000	.000

Table 6.36 – Descriptive statistics of without SMP data

Tasks	NavTools	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
	1	1.423	.159	1.096	1.750
	2	.385	.148	.081	.689
	3	1.731	.212	1.295	2.167
	4	.269	.105	.054	.485
2	1	5.885	.761	4.317	7.452
	2	.269	.105	.054	.485
	3	5.692	.748	4.152	7.233
	4	1.000	.266	.452	1.548

From the descriptive statistics, shown in Table 6.34, we can conclude that it took participants more clicks to complete the browsing tasks than fact finding tasks. We now need to perform further analysis to distinguish where the difference lies between each of the four navigation tools and whether it is statistically significant. From a paired sample t-test we determine that there is a statistically significant difference between the usage of menus and links for the two types of tasks. However, there is a slight statistical significant difference for the browser tools and no statistical significant difference in search.

Table 6.37 – Paired sample t-test results

Paired Samples Test								
	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pair 1 NFMenu - NBMenu	-4.462	3.776	.741	-5.987	-2.936	-6.025	25	.000
Pair 2 NFSearch - NBSearch	.115	.993	.195	-.286	.516	.592	25	.559
Pair 3 NFLinks - NBLinks	-3.962	3.842	.753	-5.513	-2.410	-5.258	25	.000
Pair 4 NFBrowserTools - NBBrowserTools	-.731	1.589	.312	-1.373	-.089	-2.345	25	.027

b. **With SMP**

Table 6.35 shows the descriptive statistics for the number of clicks with the SMP for fact finding task (PF). Only two participants used menus with a maximum of one click and therefore, all participants used SMP which they were instructed to use to complete the task.

Table 6.38 - Descriptive statistics for fact finding tasks (PF)

Descriptive Statistics								
	N	Minimum	Maximum	Mean	Std. Deviation	Variance	Skewness	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
PFMenu	26	0	1	.08	.272	.074	3.373	.456
PFSearch	26	0	0	.00	.000	.000	.	.
PFLinks	26	0	0	.00	.000	.000	.	.
PFBrowserTools	26	0	0	.00	.000	.000	.	.
PFSMP	26	1	3	1.23	.587	.345	2.510	.456
Valid N (listwise)	26							



Table 6.36 shows the descriptive statistics for the number of clicks with the panel for browsing task (PB). None of the participants used search and only three participants used the browser tools once. Menus and links were used by some participants and all used the SMP as instructed to do so. Menus were used more than links along with the SMP for the browsing task.

Table 6.39 - Descriptive statistics for browsing tasks (PS)

Descriptive Statistics								
	N	Minimum	Maximum	Mean	Std. Deviation	Variance	Skewness	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
PBMenu	26	0	9	1.35	2.297	5.275	2.092	.456
PBSearch	26	0	0	.00	.000	.000	.	.
PBLinks	26	0	8	1.12	1.818	3.306	2.497	.456
PBBrowserTools	26	0	1	.12	.326	.106	2.558	.456
PBSMP	26	1	10	3.92	2.925	8.554	.768	.456
Valid N (listwise)	26							

For Task 5, participants had the option to use any navigation tool(s) to complete the task. Table 6.37 shows the descriptive statistics illustrating that participants hardly used the search and browser tools to complete this task (with a mean of 0.27 and 0.69). Whereas, participants clicked on links more than menus ( $3.31 > 2.85$ ) and clicked on menus more than SMP ( $2.85 > 1.85$ ). Therefore, menus and links need to co-exist with the SMP.

Table 6.40 - Descriptive statistics for task 5

Descriptive Statistics								
	N	Minimum	Maximum	Mean	Std. Deviation	Variance	Skewness	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
T5Menu	26	0	11	<b>2.85</b>	3.133	9.815	1.448	.456
T5Search	26	0	4	.27	.827	.685	4.029	.456
T5Links	26	0	17	<b>3.31</b>	4.823	23.262	1.747	.456
T5BrowserTools	26	0	10	.69	1.995	3.982	4.389	.456
T5SMP	26	0	7	<b>1.85</b>	1.461	2.135	2.121	.456
Valid N (listwise)	26							

The results from the detailed number of clicks analysis, illustrates that without SMP, participants mostly relied on menus and links to complete their task than search and browser tools. With SMP, participants were instructed to only use SMP which they did for fact finding tasks. For browsing task, they used SMP in addition with menus and links. For task 5, they used mostly links, menus and SMP.

### 6.3.6 Study Limitations

The following were the limitations of the user study.

#### Participants

One of the limitations of the study was that we used a ‘convenient sample’ from a university community (Dalhousie University) with only 34 participants, which can reduce the generalizability of our results. However, our sample size is comparable to other similar studies which focus on users performing tasks on the web (Choo et al., 2000; Kellar et al., 2007b; Sellen et al., 2002). For an initial exploration on studying the use of SMP for the two types of tasks, we felt that the sample size of 34 provided a robust picture especially considering that we collected and analyzed both qualitative and quantitative data.

### **SMP Prototype**

Using Axure, we built the SMP prototype to be interactive and appear as if it was a browser plug-in. Even though we extracted real data from Twitter and aggregated the information to present trending web pages during the Sochi 2014 Olympic and made the entire experience interactive (i.e., users were able to click on the web page thumbnail and navigate the website as they would normally), the content within the SMP was static and did not update in real-time. For the purposes of this research, this was sufficient since we wanted to test the SMP prior to implementation, which is the intent of our future work.

### **Sochi 2014 Website**

The Sochi 2014 website was used to conduct this user study which can reduce the generalizability of the SMP usage on other websites. For the purposes of this research, it was important to minimize the number of independent variables in the study. We already had the two types of tasks (fact finding and browsing) and the two interfaces (without SMP and with SMP) as our independent variables. Still, using qualitative methods, we were able to solicit feedback on the types of websites that could benefit from SMP.

### **6.3.7 Summary**

The qualitative findings from the user study confirmed that users found SMP to be effective, efficient and engaging for browsing tasks. The quantitative findings from the user study confirmed that the two types of tasks (fact finding and browsing) were statistically significant from both the time and number of clicks perspective. It took more time and number of clicks to complete browsing tasks. However, it took less number of clicks when users used SMP. Therefore, SMP was efficient as it minimized the number of clicks used to navigate websites.

The detailed number of clicks analysis revealed that there was a statistical significant difference in the type of tasks and the navigation tools used. It took more number of clicks to complete browsing tasks than fact finding tasks and menus and links were used more than search and browser tools when participants used the interface without SMP.

With SMP, participants used menus and links in combination with SMP. Therefore, our initial theory of SMP being used as an alternate navigation tool within websites is validated with these findings and that SMP will be required to co-exist with other navigation mechanisms on websites, such as menus, search and internal links.

Table 6.41 - Summary of findings

	<b>Statistical Significance for Tasks (fact finding vs. browsing)</b>	<b>Statistical Significance for Panel (without SMP vs. with SMP)</b>	<b>Statistical Significance for Both (Task and Panel)</b>	<b>Statistical Significance for Navigation Tools</b>
<b>Time</b>	Yes (browsing tasks took longer)	No	No	N/A
<b>Total Number of Clicks</b>	Yes (browsing tasks took more clicks)	Yes (fewer clicks with SMP)	No	N/A
<b>Total Number of Clicks by Navigation Tools</b>	Yes (browsing tasks took more clicks)	Tested Individually (without SMP, and with SMP)	N/A	Menu: Yes Links: Yes Search: No Browser Tools: No SMP: Yes

## Chapter 7 – Discussion

As stated in Chapter 1, this research focuses on website navigation, particularly links internal to the target website (Phase 1: preliminary user study) and links to the target website from external sources (Phase 2: link analysis study and Phase 3: final user study). In this chapter, we describe how the studies answer the research questions and help develop a set of guidelines for a community-driven navigation mechanism on websites. This community-driven navigation mechanism is derived from aggregating link sharing data from social media sites and presenting it on websites, referred to as Social Media Panel (SMP) prototype in this research. The refinement of the web information classification model (Kellar et al., 2007) based on the final user study is described along with the future direction of this work.

### 7.1 Answers to Research Questions

Both qualitative and quantitative findings from the user studies help answer the four research questions and provide further discussion points.

In **Phase 1** of this research (described in chapter 4), we explored the following research question and the response to the research question based on the results:

**RQ1: How do users use website navigation tools (search, menu and tag cloud) for simple information seeking tasks?**

The preliminary user study indicated that participants used multiple navigation tools to find information on websites.

- a. Which of three navigation tools (search, menu and tag cloud) are perceived to be more effective, efficient and preferred in finding information for simple information seeking tasks?**

The results indicated that participants found search to be the easiest and preferred, whereas tag clouds were perceived to be efficient. Participants found search to be effective as they had the flexibility of forming the appropriate search query, however, they found the task of forming and entering the search query to be time consuming. They also found tag clouds to be efficient in finding information.

**b. Which of the two types of tag cloud (single author-driven vs. community of authors-driven) is more efficient and preferred in finding information for simple information seeking tasks?**

Participants found single author-driven tag clouds to be more efficient (in terms of number of clicks) than those created by the community of authors, primarily because of the inconsistency posed when tagging content and similarity among tags.

Based on the above findings, the following four guidelines to improve navigation within websites were developed:

- a) identify links to web pages within the target website without the need of explicit labeling (i.e., without the need of tagging);
- b) provide single-click access to web pages within the target website;
- c) provide multiple navigation tools within the target website (at least two or more);  
and
- d) provide a rationale for information that appears in the navigation tool (i.e., what does a tag in a tag cloud represent).

The lessons learned from Phase 1, which focused on internal links within the target website, were applied to Phase 2 of the research where we focused on links to the target website shared on Twitter.

In **Phase 2** of this research (described in chapter 5), we analyzed links on social media, in particularly Twitter (due to its growth potential and accessibility of APIs), during four events and explored the following two research questions along with the results:

**RQ2: What are the characteristics of links shared on social media pertaining to a target website?**

**a. How often do users share links during these four events on social media?**

The in-depth analysis of links, informed that 25-47% of tweets contained links during the four events. The London Olympics 2012 data, contained tweets with the highest number of links (47%).

**b. How many of these are unique links from four target websites?**

Tweets from the sports-related events (London Olympics 2012 and World Junior Hockey) contained the highest percentage of unique links (8% and 19%).

**c. What are the top 10 links shared from these four target websites?**

For the London Olympic 2012 event, the top 10 links made up 22% of all tweets containing links, whereas the top 10 links made up 71%, 99%, and 95% for World Junior Hockey, Big Bang Theory and Golden Globe Awards tweets respectively. Therefore, the London Olympics 2012 website contained a wide range of popular pages and not just the top10.

**d. What is the depth of links from the website's home page for the four target websites?**

Over 80% of the links were accessible within 1-2 clicks from the home page of World Junior Hockey, Big Bang Theory and Golden Globe Awards websites. For London Olympics 2012 website, 70% of links were 3-4 clicks away from the home page and 8% were 5 clicks away from the home page.

**e. What is the type of information contained in those links for the four target websites?**

Users mostly shared links containing news stories during the three events (London Olympics 2012: 28%, World Junior Hockey: 93% and Golden Globe

Awards: 14%). Links pointing to schedules/scores was noticeable for London Olympics 2012 (59%) and Golden Globe Awards (39%) only. Links pointing to photos (Big Bang Theory: 60% and Golden Globe Awards: 25%) and videos (Big Bang Theory: 40% and Golden Globe Awards: 19%) were mostly used during entertainment-related events. Few links pointed others to the home page (London Olympics 2012: 4%, World Junior Hockey: 7% and Golden Globe Awards: 4%).

**RQ3: What are the characteristics of links shared on social media pertaining to other websites?**

**a. How many links are to other websites and what type of information is contained in those links?**

For the two sports-related events (London Olympics 2012 and World Junior Hockey), the top 10 most tweeted links represents 22% and 43% of all tweets containing links to other web pages. This was in contrast to the two entertainment-related events (Big Bang Theory and Golden Globe Awards), wherein the top 10 most tweeted links represented only 9% and 10% of all tweets containing links to other pages. Furthermore, we found that tweets containing links to photos were common among all four events (London Olympics 2012: 22%, World Junior Hockey: 12%, Big Bang Theory: 4% and Golden Globe Awards: 5%). Tweets containing links to articles were common among the three events (World Junior Hockey: 3%, Big Bang Theory: 3% and Golden Globe Awards: 4%). Tweets containing links to spam was found mostly during World Junior Hockey (28%). Tweets containing links to videos were found only for Big Bang Theory (3%).

**b. Which types of websites may benefit from a community-driven navigation tool?**

We developed the following four website characteristics that may benefit from links shared in social media:



1. Websites featuring content that has the potential to be popular on social media sites, such as Twitter.
2. Websites with popular pages requiring two or more clicks from the home page.
3. Websites that are updated on a regular basis and contain content, such as articles, schedule/ scores, photos and videos.
4. Websites with social media plugins allowing users to post messages to social media from within the website.

The results of Phase 2, demonstrated that the type of the event and the characteristics of the website are important factors to consider when implementing a community-driven navigation mechanism within websites. We developed the following additional guidelines:

- e) display between 10 to 20 unique links to web pages within the target website;
- f) display in the order of most popular to least popular web pages within the target website; and
- g) exclude links that are to external websites, including spam.

An aggregated view of social media data was implemented as a prototype and referred to as Social Media Panel (SMP) in Phase 3 of this research.

In **Phase 3** of this research (described in chapter 6), we conducted a focus group with 15 participants, with the purpose to solicit feedback and refine the prototype, followed by a user study to evaluate the guidelines and the prototype, where we explored the following research question:

**RQ4: Does the use of links shared on social media, when aggregated and presented on websites, help users navigate websites more *effectively* and more *efficiently* than current navigation tools?**

**a. Does the type of web task (fact finding or browsing) affect the *efficiency, effectiveness, or engagement* of navigation based on links shared in social media?**

***Effectiveness:***

In the user study, all 34 participants completed the tasks and therefore, all navigation tools provided to them were effective. The post-task questionnaire and the post-study questionnaire captured participants' perception on the effectiveness of SMP along with its effectiveness in comparison to the current navigation tools (such as menus, search, links, and browser tools). A total of 38% (14/34) of the participants strongly agreed that they found SMP to be effective for finding information on websites in comparison to 47% (16/34) who strongly agreed that they found SMP to be effective for browsing tasks. In comparison to other tools, SMP was more preferred than menus for browsing the website (21%, (7/34) strongly agreed and 41% (14/34) somewhat agreed), more preferred than search for browsing the website (44%, (15/34) strongly agreed and 29% (10/34) somewhat agreed) and more preferred than browser tools for browsing the website (38%, (13/34) strongly agreed and 24% (8/34) somewhat agreed). However, 29% (10/34) strongly agreed and 29% (10/34) somewhat disagreed that they preferred SMP over links. Even though participants deemed SMP to be preferred for browsing tasks compared to menus, search and browser tools, they did not prefer it over links (within the content of the web page).

***Efficiency:***

Efficiency was measured by analyzing the speed of task completion along with the number of clicks taken to complete the task. Although participants on average took less amount of time to complete the fact finding task than browsing task, these findings were not statistically significant. It took participants more number of clicks to perform the browsing task than fact finding task (11 vs. 3) however, it took fewer number of clicks overall using SMP (5 vs. 9) and these findings were statistically significant. Moreover, participants were asked to rate the efficiency of SMP in the post-task questionnaire. They

indicated that they were able to reach the desired pages quickly using SMP for both the fact finding and browsing tasks, which enforces the quantitative findings illustrating the same.

### ***Engagement:***

User engagement was measured by using the three attributes developed by O'Brien (2010): perceived usability, aesthetics and novelty due to its applicability in this research. The following describes the results gathered from the questionnaires and the semi-structured interview session:

- a. **Perceived Usability:** More than 50% (17/34) of the participants strongly disagreed to statements around frustration, confusion and annoyance (such as, "*I felt frustrated while doing this task*", "*I found navigating the website to be too confusing*", "*I felt annoyed navigating the website*", "*I found SMP to be confusing to use*"), while using the SMP, which means that SMP was perceived to be user friendly by half the participants.
- b. **Aesthetics:** Participants were asked to rate a series of positive statements (such as, "*The SMP was aesthetically appealing*", "*The SMP was attractive*", etc.). Less than 45% (15/34) were in agreement (somewhat agree and strongly agree), which means that majority of the participants did not find SMP to be visually appealing.
- c. **Novelty:** More than 40% (14/34) of the participants either somewhat or strongly agreed to statements around novelty (such as, "*I continued to use the SMP out of curiosity*", "*The content of the SMP incited my curiosity*", "*I felt interested in the SMP*"). This indicated that participants found SMP to be novel.

Majority (76%, 26/34) of the participants indicated that they found SMP easy to use and that they liked using it. In conclusion, both qualitative and quantitative findings showed SMP to be effective and preferred mostly for browsing tasks. SMP was efficient in terms of the number of clicks as it took participants fewer clicks overall to complete the task.

SMP was engaging from a perceived usability and novelty perspective, however, improvements to visual aesthetics were recommended.

## 7.2 SMP Feature Enhancements

The feedback gathered from the focus group sessions as well as the user study, provided recommendations to enhance SMP. These recommendations are described in Table 7.1 along with the number of times they have been mentioned by participants in focus groups, semi-structure interviews, open-ended questions in post-task and post-study questionnaires. From this data the top three features to enhance next would be: visual appeal, sliding the panel in-and-out, and the ability to search within SMP.

Table 7.1 – SMP feature enhancements

<b>Feature Enhancements</b>	<b>Mentioned</b>	<b>Number of times mentioned (except in Focus Groups)</b>
<b>Functionality (i.e., information inside SMP)</b> <b>1. Display the number/count next to the social media icon in real-time.</b>  2. If content on a web page changes frequently, display the updated version of the web page thumbnail in real-time.  <b>3. Display additional information, such as who shared/followed the web page (i.e., friends from their social media network) and the geographic location of the users sharing such information.</b>  4. Provide the ability to share/post the web page from SMP to social media sites.  5. Provide the ability to filter on the types of web pages to display inside the SMP, such as web pages that are liked or shared,	Focus Group, Interview  Focus Group  Focus Group  Focus Group, Interview  Focus Group, Interview	6% (2/34) (P04, P36)  N/A  N/A  3% (1/34) (P12)  9% (3/34) (P01, P02, P34)

<p>web pages from a particular social media application, or web pages that are popular among their friend's network on Twitter (personalization of SMP based on the users preferences and interests).</p> <p>6. Provide the ability to search within the SMP (i.e., keyword search) so that only popular pages based on the keyword(s) are shown in SMP.</p> <p><b>7. Ability to interact with the zoomed version (preview) web page.</b></p> <p><b>8. Provide the ability to drill into the actual messages containing the link.</b></p>	<p>Focus Group, Interview</p> <p>Interview</p> <p>Interview</p>	<p>15% (5/34) (P02, P11, P18, P17, P27)</p> <p>6% (2/34) (P18, P24)</p> <p>9% (3/34) (P15, P22, P31)</p>
<p><b>Design</b></p> <p>1. Aesthetic appeal (visual appeal). Participants disliked the background color and also thought it may interfere with the website colors and therefore, it would be best to either change the background color to match with the website colors (a good contrast color) or leaving it white.</p> <p>2. Two participants indicated that it did not assist them with knowing where they have been on the website. Therefore, provide the ability to either grey out or change the color of the web page thumbnail to indicate that the web page has already been clicked.</p>	<p>Post-study questionnaire, Interview</p> <p>Post-study questionnaire</p>	<p>Over 70% indicated dissatisfaction. 35% (12/34)</p> <p>6% (2/34) (P06, P28)</p>
<p><b>Placement (i.e., location of SMP)</b></p> <p>1. Enable SMP to slide in-and-out so that it does not always require real-estate when viewing content on a web page.</p> <p>2. Enable SMP to be flexible so that one can place it horizontally or vertically anywhere on the web page.</p>	<p>Focus Group, Post-study questionnaire, Interview</p> <p>Focus Group</p>	<p>27% (9/34) (P01, P02, P04, P07, P09, P12, P16, P27, P35)</p> <p>N/A</p>

### 7.3 Association of Website Navigation Tools with Tasks

The two types of information seeking tasks, namely fact finding and browsing (Kellar et al., 2007), were used to evaluate SMP on websites. Based on the findings from the final user study, it was concluded that participants found menus and links (within the content of the web page) to be useful for fact finding tasks and SMP to be useful for browsing tasks. These findings are also enforced by task 5 where participants were allowed to use any navigation tool to complete the task and almost all started with the SMP. Using the web information classification model (Kellar et al., 2007), we propose an association of website navigation tools with tasks, where the menus and links are associated with fact finding tasks and SMP is associated with browsing tasks, as shown in Figure 7.1.

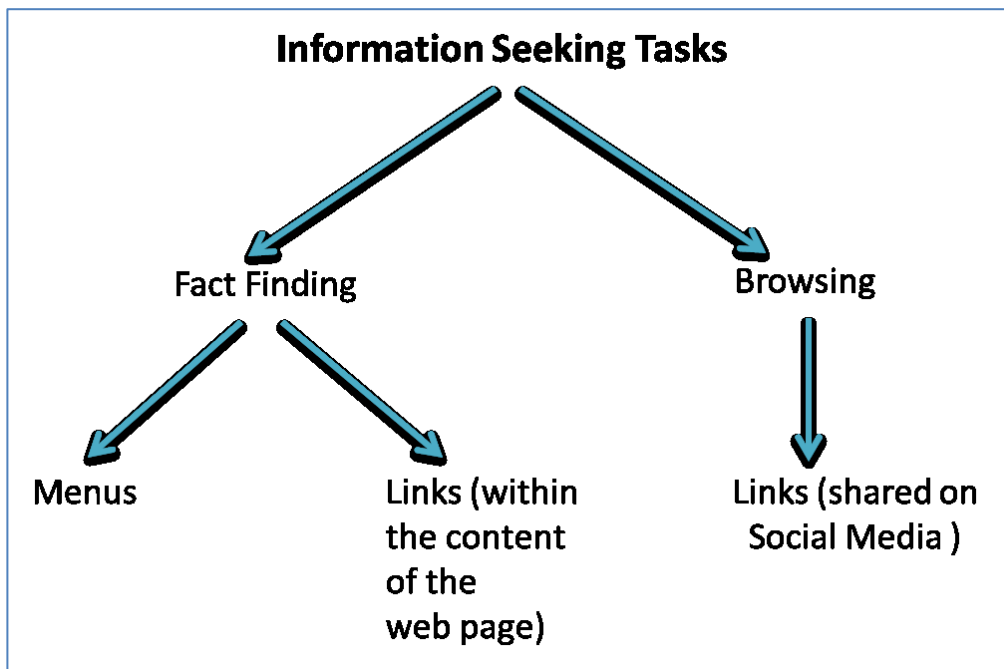


Figure 7.1 – Information seeking tasks and website navigation tools

## 7.4 Additional Findings

There were additional findings from this research, which has future implications. Table 7.2 illustrates participants responses to the two interview questions: “*Do you think SMP would be useful when you visit websites with a specific goal of finding information and why?*” and “*Do you think SMP would be useful when you visit websites to just browse and why?*”. Overall, majority (20/34) of the participants thought SMP would not be useful when you visit websites to find specific information. More females compared to males (5/34 vs. 4/34) thought SMP would be useful when you visit websites with a specific goal of finding information. Whereas, more males compared to females (12/34 vs. 8/34) thought that SMP would not be useful when you visit websites with a specific goal of finding information. In addition, more females thought it would depend on the website and the information need (whether the need is popular or not) compared to males (3:2). For browsing tasks, both males (17/34) and females (15/34) thought SMP would be useful.

Table 7.2 – Gender response analysis on two interview questions

<i>Do you think SMP would be useful when you visit websites with a specific goal of finding information and why?</i>			
	<b>Number of Females</b>	<b>Number of Males</b>	<b>Total</b>
Yes	5	4	9
No	8	12	20
Depends	3	2	5
<b>Total</b>			34
<i>Do you think SMP would be useful when you visit websites to just browse and why?</i>			
	<b>Number of Females</b>	<b>Number of Males</b>	<b>Total</b>
Yes	15	17	32
No	0	0	0
Depends	1	1	2
<b>Total</b>			34

The background literature indicates that more females use social networking sites which corresponds to how more females said SMP would be useful for finding information on a website. Even though the study had more female participants, these findings are still important to consider for future studies as it may help with the personalization of SMP.

Majority of the participants in the final user study were frequent users of Facebook (85%, 29/34), YouTube (56%, 19/34) and Instant Messaging (47%, 16/34). Out of which, majority of the users indicated that they are passive users who participate in viewing of social media content (such as viewing posts, reading comments, clicking on links, etc.) rather than contributing to social media by posting content (such as posting pictures, comments, links etc.). It is interesting to note that even though participants were not specifically contributors of information in social media, they were actively utilizing contributions of other people in their network. This concept is crucial for the sustainability of SMP since it is modeled after other people's contribution in social media (i.e., their link sharing activity). In addition, participants recommended the ability to contribute to social media from within SMP (i.e., share the link/web page from SMP to the social media site or to specific friend(s) in their network). This would encourage dissemination of information and the more links shared, the more robust tools like SMP would be, as they are derived from data shared in social media.

Trust in online social networks is important and researchers have studied the individual's decision to trust and on the processes through which trust actually emerges (Grabner-Krauter and Bitter, 2013, Sherchan et al., 2013). Acquiring trust for tools like SMP where the content is entirely user generated (based on links shared on social media), requires consideration. In both the focus group and the user study, some participants indicated concerns around user's ability to inundate social media with links to web pages that they want displayed on SMP. These concerns are valid and therefore, measures should be taken to mitigate these concerns via algorithmic techniques. In addition, adding personalization aspects to SMP may help gain trust, such as allowing users to select the social media applications to display on SMP, etc.



One of the important goals of this research was to test the concept of bringing information from social media to help websites visitors complete their information seeking tasks effectively and efficiently. Phase 3 of this research was largely focused on soliciting participants' feedback on this concept. From the focus groups and semi-structured interviews, it was found that participants perceive value in tools like SMP and such tools would be useful for browsing a website. However, some participants indicated that a usefulness of such tool would depend on the type of website (news, blogs, etc.), the users information need (whether it is popular or not) and the source of information (the social media applications, i.e., Twitter, Facebook, Google+, etc.). The consideration to use several social media application for a research objective has been explored by Becker et al. (2012) who mined event aggregation platforms to retrieve event related content shared on different social media sites (Twitter, YouTube, and Flickr). Dwyer et al. (2007) explored trust and privacy concerns within Facebook and MySpace.

Participants recommended several improvements to SMP, such as updating the number in real-time, next to the social media icon indicating the number of times the web pages has been shared on a specific social media site. They said that this feature would entice them to know why the number is increasing and encourage them to visit the web page which could potentially assist navigating within a website.

These recommendations complement existing research which demonstrates; a) users want to know what is being shared on social media instantaneously (a sense of connection) (DeAndrea et al., 2012; Haythornthwaite and Kazmer, 2002); b) users are interested in contributing to social media easily; and c) social networks facilitate new ways of interacting with information (Lerman, 2013).

## 7.5 Summary

The studies conducted as part of this research helped create the following seven guidelines to improve navigation within websites:

- a) identify links to web pages within the target website without the need of explicit labeling (i.e., without the need of tagging);
- b) provide single-click access to web pages within the target website;
- c) provide multiple navigation tools within the target website (at least two or more);
- d) provide a rationale for information that appears in the navigation tool (i.e., what does a tag in a tag cloud represent);
- e) display between 10 to 20 unique links to web pages within the target website;
- f) display in the order of most popular to least popular web pages within the target website; and
- g) exclude links that are to external websites, including spam.

Along with these guidelines, an association of navigation tools with information seeking tasks were provided, as illustrated in Figure 7.1.

## Chapter 8 – Conclusion

### 8.1 Summary

In this thesis, there were three main goals related to the examination of links on the web. First, was to gain a better understanding of how users use current navigation tools (menus, search and tag clouds) within websites (Phase 1, Chapter 4). Findings from Phase 1, were used to develop guidelines for the development of a community-driven navigation tool within websites. Second, was to further investigate links to the target website from external sources, in particularly Twitter (Phase 2, Chapter 5). Findings from Phase 2, were used to further add to the set of guidelines. Finally, we wanted to test the usefulness of these guidelines using proof of concept tools and developed a Social Media Panel (SMP) prototype using these guidelines. A focus group followed by a user study (Phase 3, Chapter 6) was conducted to evaluate the SMP and the concept in general.

In Chapter 2, we outlined previous work that has examined navigation within websites and navigation on the web in general. Previous research on website navigation tools, browser navigation tools, social navigation tools, such as tag clouds were presented. In order to better understand how users use navigation tools within websites and how the generation of content from social media could be used to improve navigation within websites, the research was divided into three phases.

In Chapter 3, we described the research methodology chosen to answer the research questions. We looked at different studies that examined user activity on the web and used mixed methodologies. Finally an overview of the research design and approach for the various controlled user studies were presented.

In Chapter 4, we presented a preliminary study which was a controlled user study to gain a better understanding of how users use current navigation tools on websites by collectively examining menus, search and tag clouds and further examining the two types of tag clouds: single author-driven and community of author-driven (Phase 1). This chapter outlined the study objectives, research question, methodology, the results and how we used the results to answer the first research question. Using these results, four

guidelines were proposed for the design and development of a community-driven navigation tool within websites.

In Chapter 5, we presented our next study, a link analysis study examining links that are shared on social media sites, to gain a better understanding of the characteristics of website links shared on social media, specifically Twitter (Phase 2). This chapter outlined the study objectives, research question, methodology, the results and how we used the results to answer the second and third research question. Using the findings from Phase 1 and this study, we were able to add to the set of guidelines and learn the characteristics of websites shared on social media. It allowed for an implementation of a prototype based on these guidelines, referred to as Social Media Panel (SMP).

In Chapter 6, we presented our final study: a focus group and a controlled user study. The purpose of this study was to test the guidelines, refine the SMP prototype and evaluate the SMP prototype via a user study. We outlined the study objectives, research question, methodology, the results and how we used the results to answer our fourth research question. Both studies helped gain a better understanding of how users navigate websites and how they navigated websites using the SMP prototype. Using the qualitative and quantitative results from the user study, we were able to answer the research question: *“Does the type of web task (fact finding or browsing) affect the **efficiency, effectiveness, or engagement** of navigation based on links shared in social media?.* Participants indicated that navigation based on links shared on social media is effective and efficient for browsing tasks. Quantitative analysis proved that participants performed the fact finding tasks faster than browsing task and the SMP did not make a significant difference in the time to complete the task. However, it was statistically proven that it took fewer clicks to perform the task using SMP. The results also helped develop a set of feature enhancements for the SMP.

In Chapter 7, we discussed the research questions and showed how the research presented in this thesis helped answer the research questions.

The studies, research questions, results and the outcomes are illustrated in Table 8.1.

Table 8.1- Research questions, results and outcomes of the three studies

Studies	Research Questions	Results	Outcomes
Phase 1: Preliminary Study	<p><b>RQ1: How do users use website navigation tools (search, menu and tag cloud) for simple information seeking tasks?</b></p> <p>a. Which of three navigation tools (search, menu and tag cloud) are perceived to be more effective, efficient and preferred in finding information for simple information seeking tasks?</p> <p>b. Which of the two types of tag cloud (single author-driven (SA) vs. community of authors-driven (CA)) is more efficient and preferred in finding information for simple information seeking tasks?</p>	<ul style="list-style-type: none"> <li>Majority (46%) use multiple navigation tools on websites.</li> </ul> <p>Effective: Search (43%) and Tag Clouds (43%)            Efficient: Tag Clouds (43%)            Preferred: Search (43%)            Easiest: Search (50%)</p> <p>Efficient:            - Time: SA faster than CA (no sig.)            - Clicks: SA req. fewer clicks than CA (statistical significance)</p> <ul style="list-style-type: none"> <li>Preferred: 64% preferred SA over CA.</li> <li>Refer to Chapter 4.</li> </ul>	<ul style="list-style-type: none"> <li>Discovered advantages and disadvantages of the three navigation tools.</li> <li>Developed 4 guidelines for an improved navigation tool on websites.</li> <li>Discovered the need to investigate links to websites from external sources (social media sites).</li> </ul>
Phase 2: Link Analysis Study	<p><b>RQ2: What are the characteristics of links shared on social media pertaining to a target website?</b></p> <p>a. How often do users share links during these four events on social media?            b. How many of these are unique links from these four target websites?            c. What are the top 10 links shared from these four target websites?            d. What is the depth of links from the website's home page for the four target websites?            e. What is the type of information contained in those links for the four target websites?</p> <p><b>RQ3: What are the characteristics of links shared on social media pertaining to other websites?</b></p> <p>a. How many links are to other websites and what type of information is contained in those links?            b. Which types of websites may benefit from a community-driven navigation tool?</p>	<ul style="list-style-type: none"> <li>25% - 47% of tweets contained links</li> <li>8% - 19% unique links</li> <li>Only 22% make up the top 10 links for London Olympics</li> <li>Majority between 1 -3 clicks away but some 4 -5 clicks</li> <li>Articles, Photos, Videos, Schedule &amp; Score page.</li> <li>Photos (22%) and spam (28%)</li> <li>Refer to Chapter 5</li> </ul>	<ul style="list-style-type: none"> <li>Developed characteristics of websites which would benefit from social media data.</li> <li>Added 3 for an improved navigation tool on websites.</li> <li>Implemented Social Media Panel (SMP) prototype based on these 7 guidelines.</li> </ul>
Phase 3: Final User Study	<p><b>RQ4: Does the use of links shared on social media, when aggregated and presented on websites, help users navigate websites more effectively and more efficiently than current navigation tools?</b></p> <p>a. Does the type of web task (fact finding or serendipitous) affect the efficiency, effectiveness, or engagement of navigation based on links shared in social media?</p>	<p>Qualitative Data</p> <p>Effective: Yes (47%)            Efficient: Yes for serendipitous tasks (44%)            Engaging: Yes for serendipitous            - Perceived Usability: Yes            - Aesthetics: No            - Novelty: Yes</p> <p>Quantitative Data</p> <p>Effective: Yes            Efficient:            - Time: More time to complete serendipitous tasks (statistically sig.)            - Clicks: More clicks to complete serendipitous task but less using SMP (statistically sig.)</p>	<ul style="list-style-type: none"> <li>Guidelines</li> <li>Suggestions for feature enhancement of SMP</li> <li>Website Link Navigation Model</li> <li>Refinement to the Web Information Classification Model (Kellar et al., 2007)</li> </ul>

## 8.2 Research Contributions

The research presented in this thesis has two types of contributions: theoretical and applied. The next section outlines each of these contributions.

### 8.2.1 Theoretical Contribution

The concept of aggregating link sharing data from social media and visually presenting it on websites is explored and evaluated in this research via focus groups and user studies. Using the results of the user study, we compared the usage of current navigation tools with the SMP prototype. We discovered that participants preferred menus and links (within the content) for fact finding tasks and the SMP prototype for browsing tasks. Therefore, the web information classification model (Kellar et al., 2007), used in this research for the purposes of task selection, can be further applied to website navigation with emphasis on the navigation tools utilized for different types of tasks, namely menus and links within the content for fact finding tasks and links shared on social media sites for browsing tasks.

The research also highlighted how the usage of SMP and the concept of aggregating social media data and presenting popular web pages to website visitors can potentially help website designers. SMP can help highlight web pages that are trending in social media. This information could be useful for several reasons. It can help identify high traffic web pages on a website, which may further be used to place important content on the web page so that it can be seen by many.

In this research, we developed the following seven guidelines for a navigation tool on websites:

- a) identify links to web pages within the target website without the need of explicit labeling (i.e., without the need of tagging);
- b) provide single-click access to web pages within the target website;
- c) provide multiple navigation tools within the target website (at least two or more);

- d) provide a rationale for information that appears in the navigation tool (i.e., what does a tag in a tag cloud represent);
- e) display between 10 to 20 unique links to web pages within the target website;
- f) display in the order of most popular to least popular web pages within the target website; and
- g) exclude links that are to external websites, including spam.

Researchers can use the information learned in the three phases of this research and the guidelines developed as a foundation for further studies. As well, the combination of methodologies (qualitative and quantitative) that we chose for studying the different website navigation tools (i.e., the focus groups and user study with semi-structured interviews) did provide a good depiction of how users navigate websites and which navigation tools are useful for different types of tasks. Researchers can use the mixed methodological approach for their research goals.

### **8.2.2 Applied Contribution**

We developed an SMP prototype which visually displayed popular web pages being shared on social media as web page thumbnails. We designed, piloted and evaluated the SMP prototype against other website navigation tools (i.e., menus, search, links and browser tools). The results showed a preference for using SMP for browsing tasks. Researchers can use the guidelines developed to design and develop website navigation tools based on social media data.

Participants also provided feedback and suggestions for improving the SMP prototype which needs to be implemented. Furthermore, we envision SMP as a browser plug-in. The concept of a browser plug-in to assist with website navigation is not new (Song, et al., 2002; Dominique, 2004). However, little research has explored the aggregation of link sharing data from social media and the presentation of popular web pages via this medium. A browser plug-in will allow users the ability to use SMP on any website as it will not rely on website designers to include it as part of the website design.

### **8.3 Limitations**

Our preliminary study and our final study involved several limitations. We used a convenience sample (university students) and while this provided a set of experienced web users, it may have also affected the generalization of our results. The size of these studies was also generally small (under 34 participants). Even though the sample is considered to be statistically significant, a larger study would be needed to fully validate the SMP prototype and the concept in general.

Several websites were used to conduct the studies. In the preliminary study, we used four different websites: Professional on the Web, Many Eyes, Web Designer Wall and Technology Education Know-How. In the link analysis study, where we examined Twitter link sharing data, we used four popular event websites: London Olympics 2012, World Junior Hockey, Big Bang Theory and Golden Globe Awards. In the final study, we used the Sochi Olympics 2014 website. Focus groups were used to select these websites. The number of websites used in each study was carefully chosen to assist with the design of the study and minimize the number of independent variables. We examined two types of information seeking tasks, namely fact finding and browsing tasks, future studies could potentially test SMP for information gathering tasks.

### **8.4 Future Work**

We have identified four main areas for potential future work, which is presented in the section below and are as follows:

1. User study with different types of websites and tasks.
2. Implementation of the Social Media Panel.
3. Customization and personalization of the Social Media Panel.
4. Exploring the use of Social Media Panel on small devices.

#### **8.4.1 User study with different types of websites and tasks**

The studies conducted in this research used a limited number of websites and tasks. The websites were mainly sports or entertainment related and the tasks were either fact



finding or browsing in nature. Even though these were sufficient for the purposes of this research, a user study consisting of a broad range of websites would be beneficial. In Phase 3 of this research, participants indicated that SMP would be useful for news, blogs and ecommerce websites. Furthermore, future work can investigate the usefulness of SMP for information gathering tasks as this type of task was not examined in this research.

#### **8.4.2 Implementation of the Social Media Panel**

We created the SMP prototype and therefore, the information presented in SMP was static (i.e., did not update in real-time). The actual implementation of the SMP would entail aggregating the link sharing data from social media sites and presenting this information as web page thumbnails in real-time. We would also like to explore the creation of SMP as a browser plug-in and test it on websites, especially news websites as recommended by the participants. We would also incorporate and evaluate the design improvements, which were identified in Phase 3 of this research.

For the purpose of this research we focused on the number of times the link was shared and did not weigh in any other factors, such as the credibility of the user who is sharing the link, the origination of the link (i.e., geographic location), the number of comments associated with the link, sentiment analysis, etc. All these factors could be taken into account in an algorithm which would assign a rank to the web pages and display them in SMP based on these rankings.

#### **8.4.3 Customization and Personalization of the Social Media Panel**

Considering the abundance of information on the web, specifically websites, users are interested in cutting the noise and seeing content that is relevant to them and presented in a manner that makes sense to them (Lerman, 2007; Guy et al., 2010; Zhou et al., 2012; Lerman, 2013;). The former relates to personalization whereas, the later relates to customization. In the context of this research, this entails enabling SMP to be customized and personalized for users visiting the website.

Participants made several recommendations on the ability to customize SMP, including the ability to indicate how many web pages to display inside SMP and also where the SMP should be displayed on the web page. Some indicated a total of 5 web pages to be part of SMP, whereas others indicated 10. Participants also indicated that they would like SMP to be flexible so that it can be easily moved when visiting the website and even displayed horizontally rather than vertically. All these recommendations, related to the customizations of SMP, would enable users to view information based on their preference.

Participants made several recommendations on the ability to personalize SMP, including the ability to select the social media sites and have web pages only from those sites appear inside SMP. This would allow participants to only see web pages from the social media site of their choice which may include those that they use and are part of or those they deem useful. In addition, it may be worthwhile to connect SMP to the users social media account (i.e., their Twitter or Facebook account) and display web pages that reflect their interests as set in their social media account. Extracting of such information would provide a personalized approach to aggregating and displaying information to users for the purposes of navigating the website. There are few factors to consider, including the fact that not all users complete their profile settings on social media and that they may not prefer this feature due to privacy concerns. Another approach would be to extract information that is shared by members of their network. Users of social media are trusting of their networks and it is most likely they will click on links that are shared in their network (Grabner-Krauter and Bitter, 2013, Sherchan et al., 2013). Therefore, it may be worthwhile exploring the concept of closely integrating the SMP to the user's social media account and presenting personalized information that is pertinent to them (i.e., their interests and information shared by members of their network).

#### **8.4.4 Exploring the use of Social Media Panel on Small Devices**

With the rapid increase in the number of mobile devices with web access (such as, iPhones, Android and Blackberry devices), understanding how users interact with SMP

on mobile devices and how they accomplish their tasks on mobile devices is important. It will also be worthwhile to explore whether users utilize SMP differently on different devices, or does the type of device influence what features they use. Do features that work well on large screen devices, namely desktops and laptops, suitable for small screen devices too? Does the design of the SMP need to be responsive to the device the user is using? Answers to these questions could help determine how SMP can be improved to assist users in their information seeking tasks on mobile devices.

## **8.5 Conclusions**

This research explored how users utilize current navigation tools within websites and how user-generated content on social media sites can assist with information seeking tasks (fact finding and browsing) within websites. We implemented a Social Media Panel (SMP) prototype to evaluate the concept and compared this prototype with the current navigation tools through a focus group and a user study.

From the studies, we gathered recommendations to improve the SMP prototype and determined whether comparatively, the SMP prototype was more effective, efficient and engaging than current navigation tools. Using data from both qualitative and quantitative techniques, we concluded that SMP would be efficient, effective and engaging. The quantitative data showed that participants completed the fact finding task faster than the browsing task. The quantitative data also showed that it took fewer clicks to complete the task with the SMP prototype but took more clicks to complete browsing tasks.

The combined results from these studies provided a set of guidelines to use for community-driven navigation on websites, a website link navigation model and a refinement of the web information classification model. We see the potential of this research to assist website visitors in helping them discover and connect with other social media users who are interested in similar topics and eventually lead these users to topic driven online communities.

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## Appendices

### Appendix 1.A – Website Navigation Tools – An Overview

Website Navigation Tools	Type of Navigation	Location/Presentation	Details
Menus	Primary navigation mechanism on most websites.	The categories are presented in a list format (either horizontally or vertically) and these are hyperlinks to other pages within the website.	Categorized are predefined by website authors and are organized based on the website's content. Menus provides access to first and second level pages within a website, limiting access to web pages requiring two or more clicks.
Search	Secondary navigation mechanism on most large websites.	On the top right corner of most websites.	Allows users to enter keyword(s) in the text box. Results are then retrieved based on those keyword(s). Search can be time consuming and may not lead to relevant result.
Breadcrumbs	Secondary navigation mechanism on most large websites where information is organized in a hierarchical manner.	Are horizontally arranged hyperlinks separated by the "greater than" (>) symbol. The symbol indicates the level of page relative to the page links beside it.	Allows users to establish where they are on a website and it allows them to revisit a previously visited page quickly. Only generated once the user starts browsing the website and they are useful only after the user follows a series of links.
Hyperlinks within Content	Primary/Secondary navigation mechanism on websites.	Hyperlinks are located on the web page.	They are created by the author of the web page.
Tag clouds (also known as, weighted list)	Secondary navigation mechanism on some websites.	A tag cloud is a visual presentation of keywords, labels or tags to illustrate content on a website. The tags are typically shown according to their frequency and appear in alphabetical order. In addition, these tags are hyperlinks which when clicked, redirects to specific pages on the website.	Tags are either generated or assigned by a single author or community of authors. They were first seen in 2004 on Flickr. Due to their popularity, they can now be found on a wide variety of websites including personal and commercial web pages, blogs, and social information sharing sites.

**Appendix 4.A – Letters from Dalhousie Research Ethics Board  
(Project #: 2010-2289)**



**Social Sciences and Humanities Research Ethics Board  
Letter of Approval**

Date: October 19, 2010.

To: Naureen Nizam, Department of Computer Science  
Dr. Carolyn Watters, Department of Computer Science

The Social Sciences Research Ethics Board has examined the following application for research involving human subjects:

**Project # 2010-2289 ( version 2 )**

**Title:** Website Navigation: An Exploratory Study of Three Navigational Elements for Simple Tasks

and found the proposed research involving human subjects to be in accordance with Dalhousie Guidelines and the Tricouncil Policy Statement on *Ethical Conduct in Research Using Human Subjects*. This approval will be in effect for 12 months from the date indicated below and is subject to the following conditions:

1. Prior to the expiry date of this approval an annual report must be submitted and approved.
2. Any significant changes to either the research methodology, or the consent form used, must be submitted for ethics review and approval *prior to their implementation*.
3. You must also notify Research Ethics when the project is completed or terminated, at which time a final report should be completed.
4. Any adverse events involving study participants are reported immediately to the REB

Effective Date: October 18, 2010.  
Expiry Date: October 18, 2011.

signed: \_\_\_\_\_  
Dr. Stephen Coughlan (Chair SSHREB)

**IMPORTANT FUNDING INFORMATION - Do not ignore**

To ensure that funding for this project is available for use, you **must** provide the following information and **FAX** this page to **RESEARCH SERVICES at 494-1595**

Name of grant /contract holder \_\_\_\_\_ Dept. \_\_\_\_\_  
Signature of grant / contract holder \_\_\_\_\_  
Funding agency \_\_\_\_\_  
Award Number \_\_\_\_\_ Dal Account # (if known) \_\_\_\_\_

Dalhousie Research Services • Research Ethics • 5248 Morris Street • Halifax, NS, Canada • B3J 1B4  
Tel: 902-494-1462 • Fax: 902-494-1595 • Email: Patricia.Lindley@dal.ca • www.dal.ca/~research



## Appendix 5.A – PHP Script to extract URLs

### Purpose:

- Searches for URLs in a tweet
- Outputs the un-shortened version of the URLs along with the rest of the information (id, publication date, author, tweet, source, short URL, Long URL, etc.)

```
<?php
function unshorten_url($url) {
    $ch = curl_init($url);
    curl_setopt_array($ch, array(
        CURLOPT_FOLLOWLOCATION => TRUE, // the magic sauce
        CURLOPT_RETURNTRANSFER => TRUE,
        CURLOPT_SSL_VERIFYHOST => FALSE, // suppress certain SSL errors
        CURLOPT_SSL_VERIFYPEER => FALSE,
        CURLOPT_TIMEOUT => 60,
    ));
    curl_exec($ch);
    $url = curl_getinfo($ch, CURLINFO_EFFECTIVE_URL);
    curl_close($ch);
    return $url;
}

//Read File
$file="SOCHI_LINKS.txt";

$fh = fopen($file, 'r'); //opening file to read.

echo "id\tguid\tlink\tpubdate\tauthor\ttitle\tDESC\tsource\tcode\tshorturl\tlongurl\n";

while (!feof($fh)) // Loop til end of file.
{
    $buffer = fgets($fh, 4096); // Read a line.
    $splitline = explode("\t", $buffer);
    $pattern = '.*?(\http[fp]://[\w#&+,\./:;=08-~]+)(\w#&+,\./:;=08-~)*?1';

    if (preg_match_all($pattern,$splitline[5],$matches)) {
        foreach($matches[1] as $URL)
        {
            echo $splitline[0]."\t".$splitline[1]."\t".$splitline[2]."\t".$splitline[3]."\t".$splitline[4]."\t".$splitline[5]."\t".$splitline[6]."\t".$splitline[7]."\t".$splitline[8]."\t";
            echo $URL."\t";
            echo unshorten_url($URL)."\n";
        }
    }
}

fclose($fh);
?>
```

## Appendix 6.A – Letters from Dalhousie Research Ethics Board (Project #: 2013-3083)



### Social Sciences & Humanities Research Ethics Board Letter of Approval

October 01, 2013

Ms Naureen Nizam  
Computer Science\Computer Science

Dear Naureen,

**REB #:** 2013-3083

**Project Title:** Using Social Media Data to Improve Navigation on Websites

**Effective Date:** October 01, 2013

**Expiry Date:** October 01, 2014

The Social Sciences & Humanities Research Ethics Board has reviewed your application for research involving humans and found the proposed research to be in accordance with the Tri-Council Policy Statement on *Ethical Conduct for Research Involving Humans*. This approval will be in effect for 12 months as indicated above. This approval is subject to the conditions listed below which constitute your on-going responsibilities with respect to the ethical conduct of this research.

Sincerely,

Dr. Sophie Jacques, Chair

---

#### Post REB Approval: On-going Responsibilities of Researchers

After receiving ethical approval for the conduct of research involving humans, there are several ongoing responsibilities that researchers must meet to remain in compliance with University and Tri-Council policies.

##### 1. Additional Research Ethics approval

Prior to conducting any research, researchers must ensure that all required research ethics approvals are secured (in addition to this one). This includes, but is not limited to, securing appropriate research ethics approvals from: other institutions with whom the PI is affiliated; the research institutions of research team members; the institution at which participants may be recruited or from which data may be collected; organizations or groups (e.g. school boards, Aboriginal communities, correctional services, long-term care facilities, service agencies and community groups) and from any other responsible review body or bodies at the research site

##### 2. Reporting adverse events

Any significant adverse events experienced by research participants must be reported **in writing** to Research Ethics **within 24 hours** of their occurrence. Examples of what might be considered “significant” include: an emotional breakdown of a participant during an interview, a negative physical reaction by a participant (e.g. fainting, nausea, unexpected pain, allergic reaction), report by a participant of some sort of negative repercussion from their participation (e.g. reaction of spouse or employer) or complaint by a participant with respect to their participation. The above list is indicative but not all-inclusive. The written report must include details of the adverse event and actions taken by the researcher in response to the incident.

### 3. Seeking approval for protocol / consent form changes

Prior to implementing any changes to your research plan, whether to the protocol or consent form, researchers must submit them to the Research Ethics Board for review and approval. This is done by completing a Request for Ethics Approval of Amendment to an Approved Project form (available on the website) and submitting three copies of the form and any documents related to the change.

### 4. Submitting annual reports

Ethics approvals are valid for up to 12 months. Prior to the end of the project’s approval deadline, the researcher must complete an Annual Report (available on the website) and return it to Research Ethics for review and approval before the approval end date in order to prevent a lapse of ethics approval for the research. Researchers should note that no research involving humans may be conducted in the absence of a valid ethical approval and that allowing REB approval to lapse is a violation of University policy, inconsistent with the TCPS (article 6.14) and may result in suspension of research and research funding, as required by the funding agency.

### 5. Submitting final reports

When the researcher is confident that no further data collection or analysis will be required, a Final Report (available on the website) must be submitted to Research Ethics. This often happens at the time when a manuscript is submitted for publication or a thesis is submitted for defence. After review and approval of the Final Report, the Research Ethics file will be closed.

### 6. Retaining records in a secure manner

Researchers must ensure that both during and after the research project, data is securely retained and/or disposed of in such a manner as to comply with confidentiality provisions specified in the protocol and consent forms. This may involve destruction of the data, or continued arrangements for secure storage. Casual storage of old data is not acceptable.

It is the Principal Investigator’s responsibility to keep a copy of the REB approval letters. This can be important to demonstrate that research was undertaken with Board approval, which can be a requirement to publish (and is required by the Faculty of Graduate Studies if you are using this research for your thesis). Please note that the University will securely store your REB project file for 5 years after the study closure date at which point the file records may be permanently destroyed.

### 7. Current contact information and university affiliation

The Principal Investigator must inform the Research Ethics office of any changes to contact information for the PI (and supervisor, if appropriate), especially the electronic mail address, for the duration of the REB approval. The PI must inform Research Ethics if there is a termination or interruption of his or her affiliation with Dalhousie University.

### 8. Legal Counsel

The Principal Investigator agrees to comply with all legislative and regulatory requirements that apply to the project. The Principal Investigator agrees to notify the University Legal Counsel office in the event that he or she receives a notice of non-compliance, complaint or other proceeding relating to such requirements.

### 9. Supervision of students

Faculty must ensure that students conducting research under their supervision are aware of their responsibilities as described above, and have adequate support to conduct their research in a safe and ethical manner.

**Social Sciences & Humanities Research Ethics Board  
Annual Renewal - Letter of Approval**

September 29, 2014

Ms Naureen Nizam  
Computer Science\Computer Science

Dear Naureen,

**REB #:** 2013-3083  
**Project Title:** Using Social Media Data to Improve Navigation on Websites  
**Expiry Date:** October 01, 2015

The Social Sciences & Humanities Research Ethics Board has reviewed your annual report and has approved continuing approval of this project up to the expiry date (above).

REB approval is only effective for up to 12 months (as per TCPS article 6.14) after which the research requires additional review and approval for a subsequent period of up to 12 months. Prior to the expiry of this approval, you are responsible for submitting an annual report to further renew REB approval. Forms are available on the Research Ethics website.

I am also including a reminder (below) of your other on-going research ethics responsibilities with respect to this research.

Sincerely,

Dr. Valerie Trifts, Chair

---

**Post REB Approval: On-going Responsibilities of Researchers**

After receiving ethical approval for the conduct of research involving humans, there are several ongoing responsibilities that researchers must meet to remain in compliance with University and Tri-Council policies.

**1. Reporting adverse events**

Any significant adverse events experienced by research participants must be reported **in writing** to Research Ethics **within 24 hours** of their occurrence. Examples of what might be considered “significant” include: an emotional breakdown of a participant during an interview, a negative physical reaction by a participant (e.g. fainting, nausea, unexpected pain, allergic reaction), report by a participant of some sort of negative repercussion from their participation (e.g. reaction of spouse or employer) or complaint by a participant with respect to their participation. The above list is indicative but not all-inclusive. The written report must include details of the adverse event and actions taken by the researcher in response to the incident.

## 2. Seeking approval for protocol / consent form changes

Prior to implementing any changes to your research plan, whether to the protocol or consent form, researchers must submit them to the Research Ethics Board for review and approval. This is done by completing a Request for Ethics Approval of Amendment to an Approved Project form (available on the website) and submitting three copies of the form and any documents related to the change. Please note that no reviews are conducted in August.

## 3. Submitting annual reports

Ethics approvals are valid for up to 12 months. Prior to the end of the project’s approval deadline, the researcher must complete an Annual Report (available on the website) and return it to Research Ethics for review and approval before the approval end date in order to prevent a lapse of ethics approval for the research. Researchers should note that no research involving humans may be conducted in the absence of a valid ethical approval and that allowing REB approval to lapse is a violation of University policy, inconsistent with the TCPS (article 6.14) and may result in suspension of research and research funding, as required by the funding agency.

## 4. Submitting final reports

When the researcher is confident that no further data collection or analysis will be required, a Final Report (available on the website) must be submitted to Research Ethics. This often happens at the time when a manuscript is submitted for publication or a thesis is submitted for defence. After review and approval of the Final Report, the Research Ethics file will be closed.

## 5. Retaining records in a secure manner

Researchers must ensure that both during and after the research project, data is securely retained and/or disposed of in such a manner as to comply with confidentiality provisions specified in the protocol and consent forms. This may involve destruction of the data, or continued arrangements for secure storage. Casual storage of old data is not acceptable. It is the Principal Investigator’s responsibility to keep a copy of the REB approval letters. This can be important to demonstrate that research was undertaken with Board approval, which can be a requirement to publish (and is required by the Faculty of Graduate Studies if you are using this research for your thesis).

Please note that the University will securely store your REB project file for 5 years after the study closure date at which point the file records may be permanently destroyed.

#### 6. Current contact information and university affiliation

The Principal Investigator must inform the Research Ethics office of any changes to contact information for the PI (and supervisor, if appropriate), especially the electronic mail address, for the duration of the REB approval. The PI must inform Research Ethics if there is a termination or interruption of his or her affiliation with Dalhousie University.

#### 7. Legal Counsel

The Principal Investigator agrees to comply with all legislative and regulatory requirements that apply to the project. The Principal Investigator agrees to notify the University Legal Counsel office in the event that he or she receives a notice of non-compliance, complaint or other proceeding relating to such requirements.

#### 8. Supervision of students

Faculty must ensure that students conducting research under their supervision are aware of their responsibilities as described above, and have adequate support to conduct their research in a safe and ethical manner.

## Appendix 6.B – Focus Group Materials

The following presentation slides were used during the focus group session, outlining the steps and the questions asked to the participants.

**FOCUS GROUP SESSION**  
November 27 & 28, 2013  
Primary Researcher: Naureen Nizam  
Supervisor: Dr. Carolyn Walters  
Supervisory Committee: Dr. Anaholy Cruz and Dr. Bonnie MacKay  
DALHOUSIE UNIVERSITY  
Business School

**Research Objective**  
Can we use **social media data** to help people navigate around the **website**?

**Prior to the session**

- Informed consent
- Demographic questionnaire
- Housekeeping Notes:
  - ▶ Audio/video recording
  - ▶ Session duration: 1 hour

**Focus Group Objective**  
Solicit feedback on the **social media panel** prototype  
+  
Gather information for the next phase of the research – user study

**Outline**

- Objectives
- Process

Step 1: Individual Exercise (5 min) → Step 2: Small Group Exercise (20 min) → Step 3: Large Group Discussion (30 min) → Feedback from Focus Group

Home Page  
Social Page  
Social media icons: Facebook, YouTube, Blogger, Twitter, LinkedIn, etc.  
Website navigation arrows pointing to Home Page and Social Page.

### Social Media Panel - Prototype

London Olympics Website (static)

Page Thumbnails

Popular on Facebook

Scrollbar

7

### Step 3: Large Group Discussion (30 min)

- 10 Questions + Sketch presentations

10

### Step 1: Individual Exercise (5 min)

- Using the computer screen in front of you, visit: <http://bit.ly/1iduU3A>
- Complete the following two tasks using the **social media panel** ONLY:
  - Find an interesting page (content) that you would like to share with the larger group.
  - Who won the men's 400m running race?

8

### Feedback Session

- Did you **like** the **social media panel** on the website?
  - Why?

11

### Step 2: Small Group Discussion (20 min)

- Online Questionnaire: <http://bit.ly/18mNh27>
  - Please keep your responses in mind as we will discuss them in the next step.
- Sketch (refer to the sheet provided)
  - Please select a presenter from your group who will describe the additions/changes in the next step (2 minute presentation).

9

### Feedback Session


- How would you use it?

12




### Feedback Session

- What features did you like about the social media panel?
  - Why?

13 

### Feedback Session

- What kind of tasks do you think this would be useful for?
  - Why?

16 


### Feedback Session

- What features did you dislike about the social media panel?
  - Why?

14 


### Feedback Session

- Sketch: What would you add/change and Why?
  - 2 minute presentation by each group

17 


### Feedback Session

- What types of websites do you think this would be useful for?
  - Why?

15 

### Feedback Session

- Do you think there is value in knowing what are the popular pages on a website based on links shared on social media?
  - Why?

18 

## Feedback Session

- When you visit websites and you have a specific goal of finding information, what type of navigation tool(s) do you gravitate towards? Do you think **social media panel** is useful for these types of tasks?
  - ▶ Why?

19



22



## Feedback Session

- When you visit websites to just browse, what type of navigation tool(s) do you gravitate towards? Do you think **social media panel** is useful for these types of tasks?
  - ▶ Why?

20



## Feedback Session

- In which scenarios do you think the **social media panel** will be useful?
  - ▶ Give an Example.

21



## Appendix 6.C – Focus Group Sketches by Participants

What would you add/change? (sketch your ideas) Group ID: 1

Can we have ~~first~~ Back & forward buttons to *Navigate* Title

If we could have a option to minimize this panel if no one uses it.

More precise images of the content / reflect the title - not just the screenshot of the entire website.

When mouse-over, may be if we could zoom-in and find more information about link.

→ May be we should categorize the likes / tweets into categories like Individual Events, Group Events etc.,

→ Option to like / Retweet or share the visited Page.

What would you add/change? (sketch your ideas) Group ID: 6

Add titles for the pages

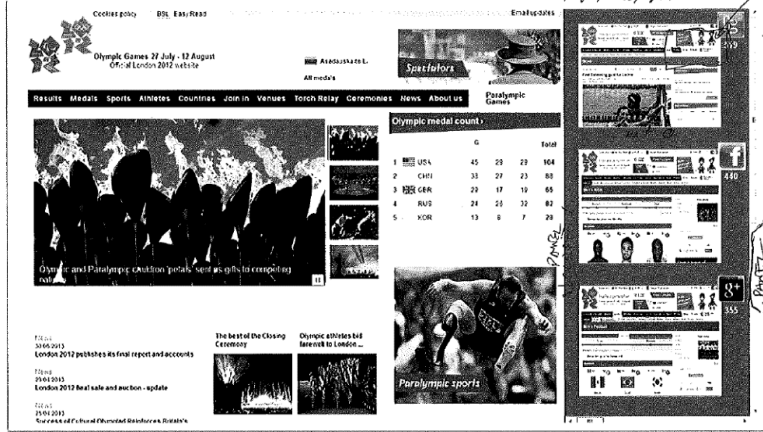
Real time update for the ranking number

Real time update of the Pages Content

	G	Total	
1 USA	45	29	104
2 CHN	35	27	85
3 GBR	22	17	65
4 KOR	24	15	82
5 NOR	13	8	28

What would you add/change? (sketch your ideas)

Group ID: 4



- info on lower
- categories for different subject
- Move info
- Who posts what
- Time info
- Location
- organization options

What would you add/change? (sketch your ideas)

Group ID: 2



- Design icons or pictures that represent such sites
- icons are fine ✓
- sleek design

What would you add/change? (sketch your ideas)

Group ID: 5

slide in or pop over

take from multiple services.

What would you add/change? (sketch your ideas)

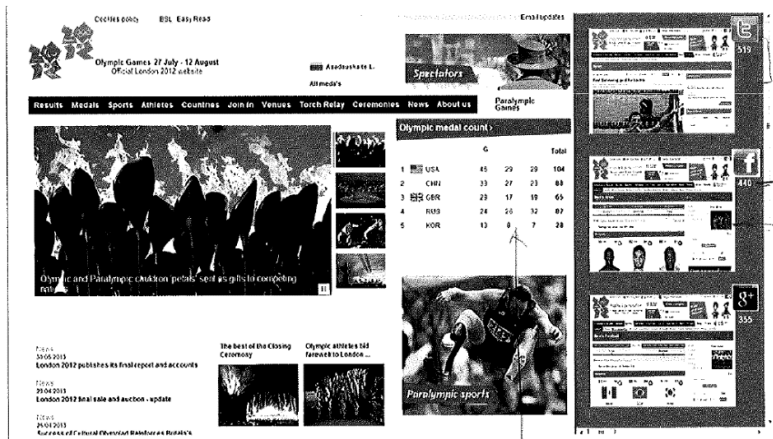
Group ID: 8

- 1) The panel should be user-friendly to navigate & fit around the webpage.
- 2) ~~Ordering~~ Reordering of various pages inside the panel should be made available.
- 3) Closing the specific content from a channel should be made available so that people can focus specifically on interest areas.
- 4) ~~Streaming~~

What would you add/change? (sketch your ideas)

Group ID: 10

*Handwritten initials/signature*



Promote social media

Likes? Shares?

Small scroll Home zoom

Enlarged ←  
→ small

## Appendix 6.D – 20 most shared web pages from Sochi 2014











## Using Social Media Data to Improve Navigation on Websites

### Social Media Usage

10. How often do you use the following social media applications?

	Very Frequently (more than once a day)	Frequently (once a day)	Occasionally (few times a week)	Infrequently (few times a month)	Very Infrequently (few times a year)	N/A
Facebook	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Twitter	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Pinterest	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Google+	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
YouTube	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tumblr	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reddit	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
LinkedIn	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Instagram	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
FourSquare	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Flickr	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Instant Messaging	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Online Games	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other (please specify in the box below)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Other:

11. What devices do you use for accessing social media? (check all that apply)

- Laptop/desktop
- Mobile phone
- Tablet/iPad
- Gaming System (e.g. Wii, Playstation, XBox)
- Other (please specify):

12. On average, how often do you do the following activities on social media (please select the appropriate frequency for each activity or N/A).

	Very Frequently (more than once a day)	Frequently (once a day)	Occasionally (few times a week)	Infrequently (few times a month)	Very Infrequently (few times a year)	N/A
Share/Post pictures	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Share/Post videos	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Share/Post comments	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Recommend/Like	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Share/Post status updates	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Share/Post links (URLs)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
View pictures	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Watch videos	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Read comments	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Read status updates	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Follow/Click on links (URLs)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

13. What platforms do you use to contribute to social media applications? (check all that apply)

- Social Media site itself (i.e. directly accessing Facebook, Twitter, etc.)
- Website (i.e. through using the social media icons on websites)
- Third Party Applications (i.e. Tweetdeck) - please indicate which application(s)?

14. Rank the top three social media applications that you use for sharing/posting links (URLs).

	1st	2nd	3rd
Facebook	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Twitter	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pinterest	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Google+	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
YouTube	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Tumblr	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Reddit	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
LinkedIn	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Instagram	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
FourSquare	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Flickr	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Instant Messaging	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Online Games	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other (please specify in the box below)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Other:



## Appendix 6.F – Post-Task Questionnaires – without Panel

\*The index of questions starts with “3”, because the first 2 questions were used to direct the participants to the appropriate questionnaire.

**User Study - Post-Task Questionnaire - NF**

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**Post-Task Questionnaire - NF**

3. Rate the usefulness of the following navigation tools in completing this task:

	Did not use	Very useful	Somewhat useful	Neutral	Not very useful	Not useful
Menu	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Search	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Links within the web page	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Browser tools (home, back and forward buttons, browser search)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

4. Which **one** of these navigation tools was the **most** useful in completing this task?

Menu  
 Search  
 Links within the web pages  
 Browser tools (home, back and forward buttons, browser search)

5. Please respond to the following statements using the given scale:

	1 Strongly Disagree	2 Somewhat Disagree	3 Neutral	4 Somewhat Agree	5 Strongly Agree	N/A
The task was clear (I understood what to do).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It was easy to complete this task.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I found the specific information on the website easily.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I found the website easy to browse.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt I completed this task successfully.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I found the navigation tool(s) I used to be helpful	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt that I completed this task quickly.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt that I was able to get to the web page directly without visiting multiple web pages.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt frustrated while doing this task.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I found navigating the website to be confusing.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Completing this task was fun.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt annoyed navigating the website.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## Appendix 6.G – Post-Task Questionnaires – with Panel

\*The index of questions starts with “3”, because the first 2 questions were used to direct the participants to the appropriate questionnaire.

**User Study - Post-Task Questionnaire - PF**

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**Post-Task Questionnaire - PF**

3. Rate the usefulness of the following navigation tools in completing this task:

	Did not use	Very useful	Somewhat useful	Neutral	Not very useful	Not useful
Menu	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Search	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Links within the web page	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Browser tools (home, back and forward buttons, browser search)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Social Media Panel	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

4. Which one of these navigation tools was the most **useful/helpful** in completing this task?

Menu  
 Search  
 Links within the web page  
 Social Media Panel  
 Browser tools (home, back and forward buttons, browser search)

Why?

5. Please respond to the following statements using the given scale:

	1 Strongly Disagree	2 Somewhat Disagree	3 Neutral	4 Somewhat Agree	5 Strongly Agree	N/A
The task was clear (I understood what to do).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It was easy to complete this task.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I found the specific information on the website easily.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I found the website easy to browse.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt I completed this task successfully.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I found the navigation tool(s) I used to be helpful	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I found the Social Media Panel to be useful/helpful in completing the task.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt that I completed this task quickly.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt that I was able to get to the web page directly without visiting multiple web pages.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt frustrated while doing this task.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I found navigating the website to be confusing.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Completing this task was fun.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt annoyed navigating the website.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I found the Social Media Panel to be confusing to use.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Finish

## Appendix 6.H – Post-Task 5 Questionnaires – with Panel

\*The index of questions starts with “2”, because the first question was used to direct the participants to the appropriate questionnaire.

**User Study - Post Task 5 Questionnaire**

Post-Task 5 Questionnaire

2. What type of task did you choose?

I was looking for something specific  
 I decided to browse  
 I did both

3. Please describe what you were looking for?

4. Rate the usefulness of the following navigation tools in completing this task:

	Did not use	Very useful	Somewhat useful	Neutral	Not very useful	Not useful
Menu	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Search	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Links within the web page	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Browser tools (home, back and forward buttons, browser search)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Social Media Panel	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

5. Which one of these navigation tools was the most **useful/helpful** in completing this task?

Menu  
 Search  
 Links within the web page  
 Social Media Panel  
 Browser tools (home, back and forward buttons, browser search)

Why?



6. Please respond to the following statements using the given scale:

	1 Strongly Disagree	2 Somewhat Disagree	3 Neutral	4 Somewhat Agree	5 Strongly Agree	N/A
The task was clear (I understood what to do).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It was easy to complete this task.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I found the specific information on the website easily.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I found the website easy to browse.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt I completed this task successfully.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I found the navigation tool(s) I used to be helpful	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I found the Social Media Panel to be useful/helpful in completing the task.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt that I completed this task quickly.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt that I was able to get to the web page directly without visiting multiple web pages.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt frustrated while doing this task.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I found navigating the website to be confusing.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Completing this task was fun.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt annoyed navigating the website.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I found the Social Media Panel to be confusing to use.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Finish

## Appendix 6.I – Post-Study Questionnaire

\*The index of questions starts with “2”, because the first question was used to direct the participants to the appropriate questionnaire.

**User Study - Post Study Questionnaire**

**Familiarity with Sochi 2014**

2. Did you follow/watch the Sochi 2014 Olympics?

Yes  
 No

3. Which team/country were you mainly supporting (i.e. rooting for) during the Sochi 2014?

4. What sports did you watch? and how familiar were you with the sport?

5. Were you familiar with the sochi 2014 website prior to this user study (i.e. had you visited the www.sochi2014.com)?

Yes  
 No

If yes, please explain your level of familiarity.

6. Which other websites did you visit related to the Sochi 2014 olympics?

news websites (CBC, BBC, etc.)  
 sports site (TSN etc.)  
 blogs  
 other (please specify in the box below)

7. During the Olympics (Sochi 2014) did you use Social Media?

Yes - I shared information (tweeted, liked etc.)  
 Yes - I followed links from friends  
 Yes - I did both the above  
 No

**Next**

## User Study - Post Study Questionnaire

### Social Media Panel Related Questions

8. Please respond to the following statements using the given scale:

	1 Strongly Disagree	2 Somewhat Disagree	3 Neutral	4 Somewhat Agree	5 Strongly Agree	N/A
It was easy to use the Social Media Panel	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I liked using the Social Media Panel	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I found the Social Media Panel useful for <b>finding information</b> on the website.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I found the Social Media Panel useful for <b>browsing</b> the website.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I preferred using the Social Media Panel to <b>find information</b> on the website more than menus.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I preferred using the Social Media Panel to <b>browse</b> the website more than menus.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I preferred using the Social Media Panel to <b>find information</b> on the website more than search.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I preferred using the Social Media Panel to <b>browse</b> the website more than search.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I preferred using the Social Media Panel to <b>find information</b> on the website more than the browser navigation tools (back, forward, home button, browser search etc.).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I preferred using the Social Media Panel to <b>browse</b> the website more than the browser navigation tools (back, forward, home button, browser search etc.).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I preferred using the Social Media Panel to <b>find information</b> on the website more than following links within the web page.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I preferred using the Social Media Panel to <b>browse</b> the website more than following links within the web page.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I found the Social Media Panel to be effective	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The Social Media Panel helped me work more efficiently	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The Social Media Panel helped me remember where I have been on the website	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would use the Social Media Panel on websites	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

9. Please respond to the following statements using the given scale:

	1 Strongly Disagree	2 Somewhat Disagree	3 Neutral	4 Somewhat Agree	5 Strongly Agree	N/A
I felt frustrated while using the Social Media Panel on this website.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I found Social Media Panel confusing to use.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt annoyed while using the Social Media Panel	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt discouraged while using the Social Media Panel	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using the Social Media Panel was mentally taxing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The experience of using the Social Media Panel was demanding	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt in control of my experience of using the Social Media Panel	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I could not do some of the things I needed to do using the Social Media Panel	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The Social Media Panel is attractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The Social Media Panel is aesthetically appealing.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I liked the graphics and images used in the Social Media Panel	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The Social Media Panel appealed to my visual senses	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The layout of the Social Media Panel was visually pleasing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I continued to use the Social Media Panel out of curiosity.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The content of the Social Media Panel incited my curiosity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt interested in the Social Media Panel	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I understood what the information inside the Social Media Panel represented.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I understood what the numbers next to the Social Media Icon meant.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

10. Please respond to the following statements regarding the features of the Social Media Panel:

	1 Strongly Disagree	2 Somewhat Disagree	3 Neutral	4 Somewhat Agree	5 Strongly Agree	N/A
I liked using the scroll bar	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I liked using the zoom feature to see the web page	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I liked the web page thumbnails	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I liked the ability to click on the web page thumbnail and it opened the page	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I liked the Social Media Icons next to the web page thumbnail	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I liked how information from multiple social media applications were displayed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I liked how I could hover over on the number to see what the number meant.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Any other comments?

11. What did you dislike about using the Social Media Panel and why?

12. What types of websites do you think would benefit from a Social Media Panel?

13. Comments/Suggestions:

Finish

## Appendix 6.J – Interview

### User Study - Semi Structured Interview Questions

#### User Study - Semi Structured Interview Questions

2. Which navigation tools do you use when you navigate websites to **find specific information**? and why?  
(Navigation Tools: Menu, Search, browser buttons etc.)

3. Which navigation tools do you use when you navigate websites to just **browse**? and why?  
(Navigation Tools: Menu, Search, browser buttons etc.)

4. What steps did you take when working with this task [researcher will select the task – if they selected they were frustrated while completing the task, then this will be selected]? Please walk-through your approach.

5. What features of the Social Media Panel did you like?

6. What features of the Social Media Panel did you dislike?

7. What improvements would you suggest to the Social Media Panel?

8. What kind of websites would benefit from a Social Media Panel and why?

9. Do you think Social Media Panel would be useful when you visit websites with a **specific goal of finding information** and why?

10. Do you think Social Media Panel would be useful when you visit websites to just **browse** and why?

11. Do you think there is value in knowing what are the popular pages on a website based on links shared on social media? Why?

12. Do you have any comments, suggestions, or questions related to this study?

Finish

## Appendix 6.K – Qualitative Data – Post-Task Questionnaire

### Usage of Navigation Tools:

w/o Social Media Panel	Fact Finding Tasks		Browsing Tasks	
	#	%	#	%
Menu	32	94%	33	97%
Search	11	32%	12	35%
Links within the web page	27	79%	33	97%
Browser Tools	11	32%	22	65%

### Usefulness of Navigation Tools:

With Social Media Panel	Fact Finding Tasks		Browsing Tasks		Task 5	
	#	%	#	%	#	%
Menu	6	18%	15	44%	26	76%
Search	1	3%	5	15%	9	26%
Links within the web page	6	18%	20	59%	28	82%
Browser Tools	2	6%	12	35%	17	50%
Social Media Panel	34	100%	34	100%	32	94%

Fact Finding Tasks without Social Media Panel	Very useful		Somewhat useful		Neutral		Not very useful		Not useful		N/A		Total
	#	%	#	%	#	%	#	%	#	%	#	%	
Menu	22	65%	9	26%	1	3%	0	0%	0	0%	2	6%	34
Search	4	12%	2	6%	1	3%	3	9%	1	3%	23	68%	34
Links within the web page	23	68%	1	3%	2	6%	0	0%	1	3%	7	21%	34
Browser Tools	6	18%	4	12%	1	3%	0	0%	0	0%	23	68%	34



Browsing Tasks without Social Media Panel	Very useful		Somewhat useful		Neutral		Not very useful		Not useful		N/A		Total
Menu	23	68%	7	21%	2	6%	1	3%	0	0%	1	3%	34
Search	2	6%	4	12%	2	6%	2	6%	2	6%	22	65%	34
Links within the web page	23	68%	9	26%	0	0%	1	3%	0	0%	1	3%	34
Browser Tools	11	32%	10	29%	1	3%	0	0%	0	0%	12	35%	34

Fact Finding Tasks with Social Media Panel	Very useful		Somewhat useful		Neutral		Not very useful		Not useful		N/A		Total
Menu	3	9%	1	3%	1	3%	0	0%	0	0%	28	85%	33
Search	0	0%	0	0%	0	0%	0	0%	0	0%	33	100%	33
Links within the web page	4	12%	1	3%	0	0%	0	0%	0	0%	28	85%	33
Browser Tools	0	0%	0	0%	1	3%	0	0%	0	0%	32	97%	33
Social Media Panel	30	88%	3	9%	0	0%	0	0%	1	3%	0	0%	34

Browsing Tasks with Social Media Panel	Very useful		Somewhat useful		Neutral		Not very useful		Not useful		N/A		Total
Menu	6	19%	2	6%	5	16%	0	0%	0	0%	19	58%	32
Search	1	3%	0	0%	2	6%	1	3%	0	0%	29	85%	33
Links within the web page	12	35%	7	21%	1	3%	0	0%	0	0%	14	42%	34
Browser Tools	3	9%	4	12%	4	12%	0	0%	0	0%	22	65%	33
Social Media Panel	24	71%	6	18%	1	3%	3	9%	0	0%	0	0%	34

Task 5 with Social Media Panel	Very useful		Somewhat useful		Neutral		Not very useful		Not useful		N/A		Total
Menu	13	39%	10	30%	2	6%	0	0%	0	0%	8	24%	33
Search	2	6%	3	9%	2	6%	2	6%	0	0%	25	74%	34
Links within the web page	13	41%	10	31%	2	6%	1	3%	0	0%	6	19%	32
Browser Tools	7	21%	4	12%	5	15%	1	3%	0	0%	17	50%	34
Social Media Panel	17	50%	13	38%	1	3%	1	3%	0	0%	2	6%	34

**Most Useful Navigation Tool:**

	Fact Finding without Social Media Panel		Browsing without Social Media Panel	
Menu	17	50%	20	59%
Search	5	15%	1	3%
Links within the web pages	11	32%	13	38%
Browser Tools	1	3%	0	0%
Total	34		34	
	Fact Finding with Social Media Panel		Browsing with Social Media Panel	
Menu	0	0%	0	0%
Search	0	0%	0	0%
Links within the web pages	0	0%	7	21%
Browser Tools	0	0%	0	0%
Social Media Panel	34	100%	27	79%
Total	34		34	

Task 5		
Menu	6	18%
Search	3	9%
Links within the web pages	7	21%
Browser Tools	0	0%
Social Media Panel	18	53%
Total	34	

Task Clarity:

Without Social Media Panel	Strongly Disagree		Somewhat Disagree		Neutral		Somewhat Agree		Strongly Agree		N / A		N
Fact Finding Task	0	0%	0	0%	0	0%	0	0%	34	100%	0	0%	34
Browsing Task	1	3%	1	3%	0	0%	3	9%	29	85%	0	0%	34
<b>With Social Media Panel</b>													
Fact Finding Task	0	0%	0	0%	0	0%	0	0%	34	100%	0	0%	34
Browsing Task	0	0%	0	0%	0	0%	6	18%	28	82%	0	0%	34
Task 5	0	0%	0	0%	1	3%	2	6%	31	91%	0	0%	34

Easy to Complete the task:

Without Social Media Panel	Strongly Disagree		Somewhat Disagree		Neutral		Somewhat Agree		Strongly Agree		N / A		N
Fact Finding Task	0	0%	1	3%	1	3%	8	24%	24	71%	0	0%	34
Browsing Task	1	3%	3	9%	2	6%	12	35%	16	47%	0	0%	34
<b>With Social Media Panel</b>													
Fact Finding Task	0	0%	1	3%	0	0%	5	15%	28	82%	0	0%	34
Browsing Task	0	0%	1	3%	6	18%	8	24%	19	56%	0	0%	34
Task 5	1	3%	2	6%	3	9%	11	32%	17	50%	0	0%	34

## Appendix 6.L – Qualitative Data – Post-Study Questionnaire

### 1. Social Media Panel Generic Questionnaire (Q8)

Categories	Questions	Strongly Disagree		Somewhat Disagree		Neutral		Somewhat Agree		Strongly Agree		N/A		N
Ease of Use	It was easy to use the SMP	0	0%	0	0%	2	6%	6	18%	26	76%	0	0%	34
Liked	I liked using the SMP	0	0%	1	3%	6	18%	13	38%	14	41%	0	0%	34
Effective	I found the SMP to be effective	0	0%	2	6%	3	9%	13	38%	16	47%	0	0%	34
Efficiently	The SMP helped me work more efficiently	0	0%	3	9%	7	21%	9	26%	15	44%	0	0%	34
Information Re-finding	The SMP helped me remember where I have been on the website	3	9%	7	21%	5	15%	6	18%	10	29%	3	9%	34
Usage	I would use SMP on websites	0	0%	0	0%	6	18%	13	38%	15	44%	0	0%	34

### 1. Social Media Panel – Comparison of Social Media Panel with other Navigation Tools (Menus, Search, Links within the web page, Browser Tools) (Q8)

Categories	Questions	Strongly Disagree		Somewhat Disagree		Neutral		Somewhat Agree		Strongly Agree		N/A		N
Fact Finding	I found the SMP to be useful for finding information on the website.	1	3%	1	3%	3	9%	16	47%	13	38%	0	0%	34
Browsing	I found the SMP useful for browsing the website	0	0%	2	6%	4	12%	12	35%	16	47%	0	0%	34
Menu (FF)	I preferred using the SMP to find information on the website more than menus	1	3%	4	12%	11	32%	12	35%	6	18%	0	0%	34
Menu (S)	I preferred	0	0%	5	15%	8	24%	14	41%	7	21%	0	0%	34

	using SMP to browse the website more than menus													
Search (FF)	I preferred using SMP to find information on the website more than search	3	9%	5	15%	2	6%	11	32%	10	29%	3	9%	34
Search (S)	I preferred using SMP to browse the website more than search	1	3%	1	3%	4	12%	10	29%	15	44%	3	9%	34
Browser Tools (FF)	I preferred using SMP to find information on the website more than the browser navigation tools (back, forward, home button)	2	6%	4	12%	7	21%	9	26%	10	29%	2	6%	34
Browser Tools (S)	I preferred using SMP to browse the website more than the browser navigation tools (back, forward, home button)	0	0%	5	15%	6	18%	8	24%	13	38%	2	6%	34
Links (FF)	I preferred using SMP to find information on the website more than following links within the web page.	1	3%	10	29%	2	6%	14	41%	7	21%	0	0%	34
Links (S)	I preferred using SMP to browse the website more than following links within the web page.	0	0%	10	29%	6	18%	8	24%	10	29%	0	0%	34

## Appendix 6.M – Speed Analysis

### a. Without SMP – Fact-Finding Task 1 (NF1)

Participant ID	Latency	Speed	Z-Score
P03	41	.024390	-.05833
P04	31	.032258	.61979
P06	106	.009434	-1.34741
P08	75	.013333	-1.01133
P09	57	.017544	-.64842
P11	71	.014085	-.94658
P15	30	.033333	.71247
P16	24	.041667	1.43071
P17	73	.013699	-.97984
P20	63	.015873	-.79243
P21	20	.050000	2.14896
P22	32	.031250	.53291
P24	64	.015625	-.81381
P26	29	.034483	.81154
P27	60	.016667	-.72403
P28	32	.031250	.53291
P33	32	.031250	.53291

#### Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Variance	Skewness	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
NF1_Speed	17	.009434	.050000	.02506706	.011602316	.000	.530	.550
Valid N (listwise)	17							

**b. Without SMP – Fact-Finding Task 2 (NF2)**

Participant ID	Latency	Speed	Z-Score
P01	48	.02083	-.57104
P02	25	.04000	.20338
P05	18	.05556	.83189
P07	14	.07143	1.47323
P10	69	.01449	-.82722
P12	128	.00781	-1.09713
P13	17	.05882	.96393
P14	117	.00855	-1.06746
P18	360	.00278	-1.30056
P23	13	.07692	1.69523
P25	25	.04000	.20338
P29	85	.01176	-.93745
P31	23	.04348	.34392
P34	20	.05000	.60742
P35	16	.06250	1.11248
P36	176	.00568	-1.18322
P37	42	.02381	-.45078

**Descriptive Statistics**

	N	Minimum	Maximum	Mean	Std. Deviation	Variance	Skewness	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
NF2_Speed Valid N (listwise)	17 17	.00278	.07692	.0349664	.02474985	.001	.222	.550

c. Without SMP – Browsing Task 1 (NB1)

Participant ID	Latency	Speed	Z-Score
P03	255	.003922	-.60247
P04	184	.005435	-.30973
P06	256	.003906	-.60544
P08	47	.021277	2.75496
P09	57	.017544	2.03284
P11	95	.010526	.67525
P15	247	.004049	-.57790
P16	240	.004167	-.55506
P17	300	.003333	-.71627
P20	141	.007092	.01090
P21	290	.003448	-.69403
P22	132	.007576	.10445
P24	240	.004167	-.55506
P26	104	.009615	.49903
P27	205	.004878	-.41744
P28	298	.003356	-.71194
P33	188	.005319	-.33210

**Descriptive Statistics**

	N	Minimum	Maximum	Mean	Std. Deviation	Variance	Skewness	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
NB1_Speed Valid N (listwise)	17 17	.003333	.021277	.00703583	.005169138	.000	1.953	.550



**d. Without SMP – Browsing Task 2 (NB2)**

Participant ID	Latency	Speed	Z-Score
P01	280	.003571	-.58047
P02	70	.014286	3.21544
P05	230	.004348	-.30541
P07	203	.004926	-.10053
P10	141	.007092	.66688
P12	267	.003745	-.51886
P13	180	.005556	.12248
P14	214	.004673	-.19024
P18	300	.003333	-.66482
P23	135	.007407	.77856
P25	360	.002778	-.86165
P29	189	.005291	.02875
P31	126	.007937	.96601
P34	292	.003425	-.63247
P35	373	.002681	-.89595
P36	267	.003745	-.51886
P37	265	.003774	-.50885

**Descriptive Statistics**

	N	Minimum	Maximum	Mean	Std. Deviation	Variance	Skewness	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
NB2_Speed Valid N (listwise)	17 17	.002681	.014286	.00520986	.002822587	.000	2.293	.550

e. With SMP – Fact Finding Task 1 (PF1)

Participant ID	Latency	Speed	Z-Score
P01	30	.033333	-.08086
P02	10	.100000	2.79961
P05	39	.025641	-.41322
P07	93	.010753	-1.05651
P10	50	.020000	-.65696
P12	20	.050000	.63925
P13	50	.020000	-.65696
P14	95	.010526	-1.06629
P18	31	.032258	-.12732
P23	13	.076923	1.80252
P25	30	.033333	-.08086
P29	25	.040000	.20718
P31	31	.032258	-.12732
P34	34	.029412	-.25030
P35	39	.025641	-.41322
P36	67	.014925	-.87622
P37	23	.043478	.35747

**Descriptive Statistics**

	N	Minimum	Maximum	Mean	Std. Deviation	Variance	Skewness	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
PF1_Speed Valid N (listwise)	17 17	.010526	.100000	.03520484	.023144380	.001	1.723	.550

f. With SMP – Fact Finding Task 2 (PF2)

Participant ID	Latency	Speed	Z-Score
P03	68	.014706	-.87445
P04	43	.023256	-.65038
P06	66	.015152	-.86277
P08	17	.058824	.28176
P09	13	.076923	.75610
P11	72	.013889	-.89586
P15	30	.033333	-.38627
P16	35	.028571	-.51107
P17	8	.125000	2.01608
P20	27	.037037	-.28921
P21	20	.050000	.05052
P22	10	.100000	1.36089
P24	37	.027027	-.55155
P26	8	.125000	2.01608
P27	80	.012500	-.93226
P28	74	.013514	-.90570
P33	16	.062500	.37811

**Descriptive Statistics**

	N	Minimum	Maximum	Mean	Std. Deviation	Variance	Skewness	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
PF2_Speed Valid N (listwise)	17 17	.012500	.125000	.04807241	.038157092	.001	1.075	.550

**g. With SMP – Browsing Task 1 (PB1)**

Participant ID	Latency	Speed	Z-Score
P01	250	.004000	-.48689
P02	150	.006667	-.02587
P05	360	.002778	-.69820
P07	278	.003597	-.55654
P10	133	.007519	.12145
P12	36	.027778	3.62390
P13	276	.003623	-.55204
P14	179	.005587	-.21260
P18	135	.007407	.10219
P23	158	.006329	-.08423
P25	200	.005000	-.31401
P29	188	.005319	-.25883
P31	96	.010417	.62244
P34	420	.002381	-.76680
P35	125	.008000	.20464
P36	195	.005128	-.29185
P37	230	.004348	-.42676

**Descriptive Statistics**

	N	Minimum	Maximum	Mean	Std. Deviation	Variance	Skewness	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
PB1_Speed Valid N (listwise)	17 17	.002381	.027778	.00681631	.005784236	.000	3.289	.550

**h. With SMP – Browsing Task 2 (PB2)**

Participant ID	Latency	Speed	Z-Score
P03	178	.005618	-.28196
P04	136	.007353	-.12240
P06	180	.005556	-.28770
P08	260	.003846	-.44491
P09	127	.007874	-.07448
P11	194	.005155	-.32458
P15	275	.003636	-.46421
P16	127	.007874	-.07448
P17	263	.003802	-.44895
P20	142	.007042	-.15097
P21	186	.005376	-.30419
P22	20	.050000	3.79980
P24	90	.011111	.22323
P26	120	.008333	-.03223
P27	360	.002778	-.54317
P28	120	.008333	-.03223
P33	254	.003937	-.43656

**Descriptive Statistics**

	N	Minimum	Maximum	Mean	Std. Deviation	Variance	Skewness	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
PB2_Speed	17	.002778	.050000	.00868383	.010873260	.000	3.842	.550
Valid N (listwise)	17							

## Appendix 6.N – Participants

### 2-Way ANOVA – all outliers removed

Participants	NF	NS	PF	PS
P01	.020833	.003571	.033333	.004000
P05	.055556	.004348	.025641	.002778
P07	.071429	.004926	.010753	.003597
P10	.014493	.007092	.020000	.007519
P13	.058824	.005556	.020000	.003623
P14	.008547	.004673	.010526	.005587
P18	.002778	.003333	.032258	.007407
P23	.076923	.007407	.076923	.006329
P25	.040000	.002778	.033333	.005000
P29	.011765	.005291	.040000	.005319
P31	.043478	.007937	.032258	.010417
P34	.050000	.003425	.029412	.002381
P35	.062500	.002681	.025641	.008000
P36	.005682	.003745	.014925	.005128
P37	.023810	.003774	.043478	.004348
P03	.024390	.003922	.014706	.005618
P04	.032258	.005435	.023256	.007353
P06	.009434	.003906	.015152	.005556
P08	.013333	.021277	.058824	.003846
P09	.017544	.017544	.076923	.007874
P11	.014085	.010526	.013889	.005155
P15	.033333	.004049	.033333	.003636
P16	.041667	.004167	.028571	.007874
P17	.013699	.003333	.125000	.003802
P20	.015873	.007092	.037037	.007042
P21	.050000	.003448	.050000	.005376
P24	.015625	.004167	.027027	.011111
P26	.034483	.009615	.125000	.008333
P27	.016667	.004878	.012500	.002778
P28	.031250	.003356	.013514	.008333
P33	.031250	.005319	.062500	.003937

## Appendix 6.0 – Total number of clicks

### a. Without SMP – Fact Finding Task 1 (NF1)

Participant ID	Number of Clicks	Z-Score
P03	2	-.98831
P04	4	.09564
P06	3	-.44633
P08	7	1.72157
P09	7	1.72157
P11	4	.09564
P15	3	-.44633
P16	2	-.98831
P17	4	.09564
P20	7	1.72157
P21	3	-.44633
P22	2	-.98831
P24	4	.09564
P26	3	-.44633
P27	6	1.17959
P28	2	-.98831
P33	2	-.98831

#### Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Variance	Skewness	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
NF1_Number_of_Clicks	17	2	7	3.82	1.845	3.404	.834	.550
Valid N (listwise)	17							

None of the z-scores were above 3.0 or below -3.0 and therefore, there were no outliers in this data set.

**b. Without SMP – Fact Finding Task 2 (NF2)**

Participant ID	Number of Clicks	Z-Score
P01	5	.01113
P02	2	-.55649
P05	2	-.55649
P07	2	-.55649
P10	4	-.17808
P12	6	.20034
P13	3	-.36728
P14	7	.38954
P18	24	3.60604
P23	2	-.55649
P25	2	-.55649
P29	5	.01113
P31	2	-.55649
P34	3	-.36728
P35	2	-.55649
P36	8	.57875
P37	5	.01113

**Descriptive Statistics**

	N	Minimum	Maximum	Mean	Std. Deviation	Variance	Skewness	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
NF2_Number_of_Clicks	17	2	24	4.94	5.285	27.934	3.247	.550
Valid N (listwise)	17							

One outlier was found in this data set (P18) with a z-score of 3.60604. Participant P18 was removed from the rest of the number of clicks analysis, leaving NF2 with 16 data points instead of 17. In addition, the skewness of the data set is 3.247 which is considerably high. After the removal of participant P18, the skewness is .836.

**Descriptive Statistics**

	N	Minimum	Maximum	Mean	Std. Deviation	Variance	Skewness	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error



NF2_Number_of_Clicks	16	2	8	3.75	2.017	4.067	.836	.564
Valid N (listwise)	16							

**c. Without SMP – Browsing Task 1 (NB1)**

Participant ID	Number of Clicks	Z-Score
P03	17	.82990
P04	13	.14998
P06	11	-.18998
P08	4	-1.37984
P09	5	-1.20986
P11	11	-.18998
P15	17	.82990
P16	17	.82990
P17	20	1.33984
P20	15	.48994
P21	26	2.35972
P22	7	-.86990
P24	10	-.35996
P26	6	-1.03988
P27	8	-.69992
P28	9	-.52994
P33	10	-.35996

**Descriptive Statistics**

	N	Minimum	Maximum	Mean	Std. Deviation	Variance	Skewness	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
NB1_Number_of_Clicks	17	4	26	12.12	5.883	34.610	.751	.550
Valid N (listwise)	17							

None of the z-scores were above 3.0 or below -3.0 and therefore, there were no outliers in this data set.

**d. Without SMP – Browsing Task 2 (NB2)**

Participant ID	Number of Clicks	Z-Score
P01	12	-.30628
P02	5	-1.19522
P05	16	.20169
P07	15	.07470
P10	7	-.94124
P12	9	-.68725
P13	10	-.56026
P14	14	-.05229
P18	21	.83666
P23	10	-.56026
P25	35	2.61455
P29	12	-.30628
P31	4	-1.32222
P34	14	-.05229
P35	27	1.59861
P36	20	.70966
P37	14	-.05229

**Descriptive Statistics**

	N	Minimum	Maximum	Mean	Std. Deviation	Variance	Skewness	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
NB2_Number_of_Clicks	17	4	35	14.41	7.874	62.007	1.227	.550
Valid N (listwise)	17							

None of the z-scores were above 3.0 or below -3.0 and therefore, there were no outliers in this data set.

e. With SMP – Fact Finding Task 1 (PF1)

Participant ID	Number of Clicks	Z-Score
P01	2	.37891
P02	1	-.69466
P05	1	-.69466
P07	4	2.52604
P10	2	.37891
P12	1	-.69466
P13	2	.37891
P14	3	1.45247
P18	2	.37891
P23	1	-.69466
P25	3	1.45247
P29	1	-.69466
P31	1	-.69466
P34	1	-.69466
P35	1	-.69466
P36	1	-.69466
P37	1	-.69466

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Variance	Skewness	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
PF1_Number_of_Clicks	17	1	4	1.65	.931	.868	1.354	.550
Valid N (listwise)	17							

None of the z-scores were above 3.0 or below -3.0 and therefore, there were no outliers in this data set.

**f. With SMP – Fact Finding Task 2 (PF2)**

Participant ID	Number of Clicks	Z-Score
P03	1	-.50285
P04	3	2.34661
P06	2	.92188
P08	1	-.50285
P09	1	-.50285
P11	1	-.50285
P15	1	-.50285
P16	1	-.50285
P17	1	-.50285
P20	1	-.50285
P21	1	-.50285
P22	1	-.50285
P24	1	-.50285
P26	1	-.50285
P27	2	.92188
P28	3	2.34661
P33	1	-.50285

**Descriptive Statistics**

	N	Minimum	Maximum	Mean	Std. Deviation	Variance	Skewness	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
PF2_Number_of_Clicks	17	1	3	1.35	.702	.493	1.825	.550
Valid N (listwise)	17							

None of the z-scores were above 3.0 or below -3.0 and therefore, there were no outliers in this data set.

**g. With SMP – Browsing Task 1 (PB1)**

Participant ID	Number of Clicks	Z-Score
P01	15	1.46473
P02	4	-.59470
P05	14	1.27751
P07	17	1.83917
P10	1	-1.15636
P12	1	-1.15636
P13	13	1.09028
P14	8	.15418
P18	1	-1.15636
P23	6	-.22026
P25	12	.90306
P29	4	-.59470
P31	2	-.96914
P34	9	.34140
P35	3	-.78192
P36	8	.15418
P37	4	-.59470

**Descriptive Statistics**

	N	Minimum	Maximum	Mean	Std. Deviation	Variance	Skewness	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
PB1_Number_of_Clicks	17	1	17	7.18	5.341	28.529	.486	.550
Valid N (listwise)	17							

None of the z-scores were above 3.0 or below -3.0 and therefore, there were no outliers in this data set.

**h. With SMP – Browsing Task 2 (PB2)**

Participant ID	Number of Clicks	Z-Score
P03	5	-.38720
P04	2	-.74624
P06	11	.33088
P08	32	2.84416
P09	1	-.86592
P11	7	-.14784
P15	9	.09152
P16	1	-.86592
P17	14	.68992
P20	10	.21120
P21	6	-.26752
P22	1	-.86592
P24	3	-.62656
P26	2	-.74624
P27	23	1.76704
P28	5	-.38720
P33	8	-.02816

**Descriptive Statistics**

	N	Minimum	Maximum	Mean	Std. Deviation	Variance	Skewness	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
PB2_Number_of_Clicks	17	1	32	8.24	8.356	69.816	1.823	.550
Valid N (listwise)	17							

None of the z-scores were above 3.0 or below -3.0 and therefore, there were no outliers in this data set.

## Appendix 6.P – Participants

Participants	NF	NB	PF	PB	
P01		5	12	2	15
P02		2	5	1	4
P05		2	16	1	14
P07		2	15	4	17
P10		4	7	2	1
P12		6	9	1	1
P13		3	10	2	13
P14		7	14	3	8
P23		2	10	1	6
P25		2	35	3	12
P29		5	12	1	4
P31		2	4	1	2
P34		3	14	1	9
P35		2	27	1	3
P36		8	20	1	8
P37		5	14	1	4
P03		2	17	1	5
P04		4	13	3	2
P06		3	11	2	11
P08		7	4	1	32
P09		7	5	1	1
P11		4	11	1	7
P15		3	17	1	9
P16		2	17	1	1
P17		4	20	1	14
P20		7	15	1	10
P21		3	26	1	6
P22		2	7	1	1
P24		4	10	1	3
P26		3	6	1	2
P27		6	8	2	23
P28		2	9	3	5
P33		2	10	1	8

## Appendix 6.Q – Click analysis for each navigation tool

### A. Without Panel – Fact Finding Task (NF1 and NF2)

Participant ID	Treatment	Menu	Search	Links with in Content	Browser Tools	ZScore_Menu	ZScore_Search	ZScore_Links	ZScore_BrowserTools
P03	NF1	0	1	1	0	-1.24768	1.06716	-.51781	-.57809
P04	NF1	1	0	2	1	-.49016	-.58209	.73973	.82584
P06	NF1	1	0	1	1	-.49016	-.58209	-.51781	.82584
P08	NF1	1	2	2	2	-.49016	2.71640	.73973	2.22977
P09	NF1	3	0	3	1	1.02488	-.58209	1.99726	.82584
P11	NF1	2	1	1	0	.26736	1.06716	-.51781	-.57809
P15	NF1	2	0	1	0	.26736	-.58209	-.51781	-.57809
P16	NF1	1	0	1	0	-.49016	-.58209	-.51781	-.57809
P17	NF1	1	1	2	0	-.49016	1.06716	.73973	-.57809
P20	NF1	2	0	3	2	.26736	-.58209	1.99726	2.22977
P21	NF1	2	0	1	0	.26736	-.58209	-.51781	-.57809
P22	NF1	1	0	1	0	-.49016	-.58209	-.51781	-.57809
P24	NF1	1	1	2	0	-.49016	1.06716	.73973	-.57809
P26	NF1	2	0	1	0	.26736	-.58209	-.51781	-.57809
P27	NF1	6	0	0	0	3.29745	-.58209	-1.77534	-.57809
P28	NF1	1	0	1	0	-.49016	-.58209	-.51781	-.57809
P33	NF1	1	0	1	0	-.49016	-.58209	-.51781	-.57809

Participant ID	Treatment	Menu	Search	Links with in Content	Browser Tools	ZScore_Menu	ZScore_Search	ZScore_Links	ZScore_BrowserTools
P01	NF2	0	1	4	0	-1.31358	.20952	.79963	-.34648
P02	NF2	1	0	1	0	-.29854	-.50285	-.65684	-.34648
P05	NF2	1	0	1	0	-.29854	-.50285	-.65684	-.34648
P07	NF2	1	0	1	0	-.29854	-.50285	-.65684	-.34648
P10	NF2	1	1	2	0	-.29854	.20952	-.17135	-.34648
P12	NF2	3	0	2	1	1.73154	-.50285	-.17135	.24254
P13	NF2	1	0	2	0	-.29854	-.50285	-.17135	-.34648
P14	NF2	1	2	3	1	-.29854	.92188	.31414	.24254
P18	NF2	3	5	9	7	1.73154	3.05898	3.22709	3.77663



<b>P23</b>	NF2	1	0	1	0	-.29854	-.50285	-.65684	-.34648
<b>P25</b>	NF2	0	0	2	0	-1.31358	-.50285	-.17135	-.34648
<b>P29</b>	NF2	2	0	2	1	.71650	-.50285	-.17135	.24254
<b>P31</b>	NF2	1	0	1	0	-.29854	-.50285	-.65684	-.34648
<b>P34</b>	NF2	2	0	1	0	.71650	-.50285	-.65684	-.34648
<b>P35</b>	NF2	1	0	1	0	-.29854	-.50285	-.65684	-.34648
<b>P36</b>	NF2	0	3	5	0	-1.31358	1.63425	1.28512	-.34648
<b>P37</b>	NF2	3	0	2	0	1.73154	-.50285	-.17135	-.34648

The potential outliers are participant 27 for NF1 and participant 18 for NF2.

### NF1

#### Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Menu	17	.00	6.00	1.6471	1.32009
Search	17	.00	2.00	.3529	.60634
LinksWithinContent	17	.00	3.00	1.4118	.79521
BrowserTools	17	.00	2.00	.4118	.71229
Valid N (listwise)	17				

### NF2

#### Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Menu	17	0	3	1.29	.985
Search	17	0	5	.71	1.404
LinksWithinContent	17	1	9	2.35	2.060
BrowserTools	17	0	7	.59	1.698
Valid N (listwise)	17				

B. Without Panel – Browsing Task (NB1 and NB2)

Participant ID	Treatment	Menu	Search	Links with Content	Browser Tools	ZScore_Menu	ZScore_Search	ZScore_Links	ZScore_BrowserTools
P03	NB1	2	3	9	3	-.95210	2.97409	1.04648	1.07041
P04	NB1	6	0	6	1	.20402	-.47315	.24990	-.22937
P06	NB1	1	0	10	0	-1.24113	-.47315	1.31200	-.87927
P08	NB1	3	0	1	0	-.66307	-.47315	-1.07771	-.87927
P09	NB1	0	1	2	2	-1.53016	.67593	-.81219	.42052
P11	NB1	6	0	4	1	.20402	-.47315	-.28114	-.22937
P15	NB1	10	2	4	1	1.36014	1.82501	-.28114	-.22937
P16	NB1	5	1	7	4	-.08501	.67593	.51543	1.72030
P17	NB1	9	0	8	3	1.07111	-.47315	.78095	1.07041
P20	NB1	14	0	1	0	2.51626	-.47315	-1.07771	-.87927
P21	NB1	6	0	15	5	.20402	-.47315	2.63962	2.37020
P22	NB1	2	0	5	0	-.95210	-.47315	-.01562	-.87927
P24	NB1	5	0	4	1	-.08501	-.47315	-.28114	-.22937
P26	NB1	4	0	2	0	-.37404	-.47315	-.81219	-.87927
P27	NB1	5	0	2	1	-.08501	-.47315	-.81219	-.22937
P28	NB1	7	0	2	0	.49305	-.47315	-.81219	-.87927
P33	NB1	5	0	4	1	-.08501	-.47315	-.28114	-.22937

Participant ID	Treatment	Menu	Search	Links	Browser Tools	ZScore_Menu	ZScore_Search	ZScore_Links	ZScore_BrowserTools
P01	NB2	1	1	8	2	-1.23599	1.74895	.12073	1.27331
P02	NB2	2	0	2	1	-.99990	-.53814	-.75887	.24254
P05	NB2	8	0	6	2	.41663	-.53814	-.17247	1.27331
P07	NB2	4	1	9	1	-.52773	1.74895	.26733	.24254
P10	NB2	1	0	4	2	-1.23599	-.53814	-.46567	1.27331
P12	NB2	6	0	3	0	-.05555	-.53814	-.61227	-.78824
P13	NB2	4	0	5	1	-.52773	-.53814	-.31907	.24254
P14	NB2	10	0	4	0	.88880	-.53814	-.46567	-.78824
P18	NB2	14	1	5	1	1.83316	1.74895	-.31907	.24254
P23	NB2	5	0	5	0	-.29164	-.53814	-.31907	-.78824
P25	NB2	2	0	30	3	-.99990	-.53814	3.34595	2.30409
P29	NB2	8	0	4	0	.41663	-.53814	-.46567	-.78824
P31	NB2	2	0	2	0	-.99990	-.53814	-.75887	-.78824

<b>P34</b>	NB2	8	1	5	0	.41663	1.74895	-.31907	-.78824
<b>P35</b>	NB2	14	0	13	0	1.83316	-.53814	.85373	-.78824
<b>P36</b>	NB2	6	0	14	0	-.05555	-.53814	1.00033	-.78824
<b>P37</b>	NB2	11	0	3	0	1.12489	-.53814	-.61227	-.78824

**NB1:**

**Descriptive Statistics**

	N	Minimum	Maximum	Mean	Std. Deviation
Menu	17	0	14	5.29	3.460
Search	17	0	3	.41	.870
LinksWithinContent	17	1	15	5.06	3.766
BrowserTools	17	0	5	1.35	1.539
Valid N (listwise)	17				

**NB2:**

**Descriptive Statistics**

	N	Minimum	Maximum	Mean	Std. Deviation
Menu	17	1	14	6.24	4.236
Search	17	0	1	.24	.437
LinksWithinContent	17	2	30	7.18	6.821
BrowserTools	17	0	3	.76	.970
Valid N (listwise)	17				

C. With Panel – Fact Finding Task (PF1 and PF2)

Participant ID	Treatment	Menu	Search	Links	Browser Tools	SMP	Z-Menu	Z-SMP
P01	PF1	0	0	0	0	2	-.62622	.92188
P02	PF1	0	0	0	0	1	-.62622	-.50285
P05	PF1	0	0	0	0	1	-.62622	-.50285
P07	PF1	1	0	0	0	3	1.50294	2.34661
P10	PF1	1	0	0	0	1	1.50294	-.50285
P12	PF1	0	0	0	0	1	-.62622	-.50285
P13	PF1	1	0	0	0	1	1.50294	-.50285
P14	PF1	0	0	0	0	3	-.62622	2.34661
P18	PF1	1	0	0	0	1	1.50294	-.50285
P23	PF1	0	0	0	0	1	-.62622	-.50285
P25	PF1	1	0	0	0	2	1.50294	.92188
P29	PF1	0	0	0	0	1	-.62622	-.50285
P31	PF1	0	0	0	0	1	-.62622	-.50285
P34	PF1	0	0	0	0	1	-.62622	-.50285
P35	PF1	0	0	0	0	1	-.62622	-.50285
P36	PF1	0	0	0	0	1	-.62622	-.50285
P37	PF1	0	0	0	0	1	-.62622	-.50285

PF1:

**Descriptive Statistics**

	N	Minimum	Maximum	Mean	Std. Deviation
Menu	17	0	1	.29	.470
Search	17	0	0	.00	.000
LinksWithinContent	17	0	0	.00	.000
BrowserTools	17	0	0	.00	.000
SMP	17	1	3	1.35	.702
Valid N (listwise)	17				

Participant ID	Treatment	Menu	Search	Links	Browser Tools	SMP	Z-Menu	Z-SMP
P03	PF2	0	0	0	0	1	-.33385	-.33385
P04	PF2	0	0	0	0	3	-.33385	3.44977
P06	PF2	0	0	0	0	2	-.33385	1.55796
P08	PF2	0	0	0	0	1	-.33385	-.33385
P09	PF2	0	0	0	0	1	-.33385	-.33385
P11	PF2	0	0	0	0	1	-.33385	-.33385
P15	PF2	0	0	0	0	1	-.33385	-.33385
P16	PF2	0	0	0	0	1	-.33385	-.33385
P17	PF2	0	0	0	0	1	-.33385	-.33385
P20	PF2	0	0	0	0	1	-.33385	-.33385
P21	PF2	0	0	0	0	1	-.33385	-.33385
P22	PF2	0	0	0	0	1	-.33385	-.33385
P24	PF2	0	0	0	0	1	-.33385	-.33385
P26	PF2	0	0	0	0	1	-.33385	-.33385
P27	PF2	1	0	0	0	1	1.55796	-.33385
P28	PF2	2	0	0	0	1	3.44977	-.33385
P33	PF2	0	0	0	0	1	-.33385	-.33385

PF2:

**Descriptive Statistics**

	N	Minimum	Maximum	Mean	Std. Deviation
Menu	17	0	2	.18	.529
Search	17	0	0	.00	.000
LinksWithinContent	17	0	0	.00	.000
BrowserTools	17	0	0	.00	.000
SMP	17	1	3	1.18	.529
Valid N (listwise)	17				

D. With Panel – Browsing Task (PB1 and PB2)

Part icipant ID	Treat ment	Menu	Searc h	Link s	Browse r Tools	SM P	Z- Menu	Z- Links	Z- Brow ser Tools	Z-SMP
<b>P01</b>	PB1	5	0	8	1	1	1.8252 1	2.6137 0	.7165 0	-.90580
<b>P02</b>	PB1	0	0	1	0	3	- .67709	- .32055	- .2985 4	-.25054
<b>P05</b>	PB1	6	0	2	0	6	2.3256 7	.09863	- .2985 4	.73235
<b>P07</b>	PB1	3	0	4	0	10	.82429	.93699	- .2985 4	2.04286
<b>P10</b>	PB1	0	0	0	0	1	- .67709	- .73973	- .2985 4	-.90580
<b>P12</b>	PB1	0	0	0	0	1	- .67709	- .73973	- .2985 4	-.90580
<b>P13</b>	PB1	0	0	6	4	3	- .67709	1.7753 4	3.761 61	-.25054
<b>P14</b>	PB11	2	0	3	0	3	.32383	.51781	- .2985 4	-.25054
<b>P18</b>	PB1	0	0	0	0	1	- .67709	- .73973	- .2985 4	-.90580
<b>P23</b>	PB1	0	0	0	0	6	- .67709	- .73973	- .2985 4	.73235
<b>P25</b>	PB1	1	0	0	0	11	- .17663	- .73973	- .2985 4	2.37049
<b>P29</b>	PB1	0	0	1	0	3	- .67709	- .32055	- .2985 4	-.25054
<b>P31</b>	PB1	0	0	0	0	2	- .67709	- .73973	- .2985 4	-.57817
<b>P34</b>	PB1	4	0	3	0	2	1.3247 5	.51781	- .2985	-.57817

									4	
<b>P35</b>	PB1	0	0	0	0	3	-	-	-	-.25054
							.67709	.73973	.2985	
									4	
<b>P36</b>	PB1	2	0	0	0	6	.32383	-	-	.73235
								.73973	.2985	
									4	
<b>P37</b>	PB1	0	0	2	0	2	-	.09863	-	-.57817
							.67709		.2985	
									4	

**Descriptive Statistics**

	N	Minimum	Maximum	Mean	Std. Deviation
Menu	17	0	6	1.35	1.998
Search	17	0	0	.00	.000
LinksWithinContent	17	0	8	1.76	2.386
BrowserTools	17	0	4	.29	.985
SMP	17	1	11	3.76	3.052
Valid N (listwise)	17				

Parti cipa nt ID	Treat ment	Menu	Search	Links	Browser Tools	S M P	Z- Menu	Z- Searc h	Z- Links	Z- Brows er Tools	Z- SMP
<b>P03</b>	PB2	1	1	2	0	1	- .2318 3	3.880 57	.2273 2	- .29196	- 1.060 6
	PB2	0	0	0	0	2	- .4945 8	- .2425 4	- .3672 2	- .29196	- .7443 4
<b>P04</b>	PB2	1	0	1	1	8	- .2318 3	- .2425 4	- .0699 5	.12165	1.153 73
	PB2	3	0	14	10	5	.2936 6	- .2425 4	3.794 56	3.8440 9	.2046 9
<b>P06</b>	PB2	0	0	0	0	1	- .4945 8	- .2425 4	- .3672 2	- .29196	- 1.060 6
	PB2	1	0	1	0	5	- .2318 3	- .2425 4	- .0699 5	- .29196	.2046 9
<b>P08</b>	PB2	0	0	1	0	8	- .4945 8	- .2425 4	- .0699 5	- .29196	1.153 73
	PB2	0	0	0	0	1	- .4945 8	- .2425 4	- .3672 2	- .29196	- 1.060 6
<b>P09</b>	PB2	1	0	1	0	5	- .2318 3	- .2425 4	- .0699 5	- .29196	.2046 9
	PB2	0	0	1	0	8	- .4945 8	- .2425 4	- .0699 5	- .29196	1.153 73
<b>P11</b>	PB2	0	0	0	0	1	- .4945 8	- .2425 4	- .3672 2	- .29196	- 1.060 6
	PB2	1	0	2	1	1 0	- .2318 3	- .2425 4	.2273 2	.12165	1.786 41
<b>P15</b>	PB2	9	0	0	0	1	1.870 13	- .2425 4	- .3672 2	- .29196	- 1.060 6
	PB2	0	0	0	0	6	- .4945 8	- .2425 4	- .3672 2	- .29196	.5210 4
<b>P16</b>	PB2	0	0	0	0	1	- .4945 8	- .2425 4	- .3672 2	- .29196	- 1.060 6
	PB2	0	0	0	0	1	- .4945 8	- .2425 4	- .3672 2	- .29196	- 1.060 6
<b>P17</b>	PB2	0	0	0	0	6	- .4945 8	- .2425 4	- .3672 2	- .29196	.5210 4
	PB2	0	0	0	0	1	- .4945 8	- .2425 4	- .3672 2	- .29196	- 1.060 6
<b>P20</b>	PB2	0	0	0	0	1	- .4945 8	- .2425 4	- .3672 2	- .29196	- 1.060 6
	PB2	0	0	0	0	1	- .4945 8	- .2425 4	- .3672 2	- .29196	- 1.060 6
<b>P21</b>	PB2	0	0	0	0	1	- .4945 8	- .2425 4	- .3672 2	- .29196	- 1.060 6
	PB2	0	0	0	0	1	- .4945 8	- .2425 4	- .3672 2	- .29196	- 1.060 6
<b>P22</b>	PB2	0	0	0	0	1	- .4945 8	- .2425 4	- .3672 2	- .29196	- 1.060 6
	PB2	0	0	0	0	1	- .4945 8	- .2425 4	- .3672 2	- .29196	- 1.060 6



<b>P24</b>	PB2	0	0	0	0	3	-	-	-	-	-
							.4945	.2425	.3672	.29196	.4279
<b>P26</b>	PB2	0	0	0	0	2	-	-	-	-	-
							.4945	.2425	.3672	.29196	.7443
<b>P27</b>	PB2	14	0	0	0	9	3.183	-	-	-	1.470
							.86	.2425	.3672	.29196	.07
<b>P28</b>	PB2	1	0	0	0	4	-	-	-	-	-
							.2318	.2425	.3672	.29196	.1116
<b>P33</b>	PB2	1	0	0	0	7	-	-	-	-	.8373
							.2318	.2425	.3672	.29196	.8

#### Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Menu	17	0	14	1.88	3.806
Search	17	0	1	.06	.243
LinksWithinContent	17	0	14	1.24	3.364
BrowserTools	17	0	10	.71	2.418
SMP	17	1	10	4.35	3.161
Valid N (listwise)	17				