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UNDERSTANDING THE IMPACT OF WEB LAYOUT AND EMOTIONAL CHANGES TOWARDS NAVIGATION BEHAVIOUR AMONG VISUALLY IMPAIRED USERS

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ABSTRACT

Facebook is the largest social network and it's widely used by everyone. Facebook consists of webpages designed in modular layouts. Assistive technologies such as screen readers not able interpret the content in complex layout to visually impaired (VI) users. This causes lots of troubles to VI users. In order to understand the impact of layout to VI users' navigation behavior, we conducted a comparison study of how VI users navigate in Facebook desktop and mobile version. Besides, this article examines the relationships between users' emotions and their navigation behavior in complex layout. The result shows that VI users prefer Facebook mobile version compares to desktop version. The study revealed that there is a strong relationship between users' emotions and their navigation behavior. The understanding of VI users' navigation behavior and their emotions changes can help web designers to bridge the gap between the user and system.

Keywords: *Facebook, Modular Layout, Visually Impaired Users, Emotion*

1. INTRODUCTION

Social networking sites (SNS) have become vitally important both for work and leisure activities. Boyd defines SNS as web-based services that allow users to share a public or private profile with common users and explore connections with others within the site[1]. SNS is very popular among internet web users recent years. The popularity of SNS has increased drastically and it became core part in everybody life. Obtaining latest news and information is one of the unique contributions of SNS. For many disabled people, social networking websites offer huge opportunities to conduct business and to socialize without physical barriers. Although, SNS constitute one of most popular categories of Web with millions of dedicated users, user-centered studies contrarily showed that SNS performed poorly in terms of traditional web usability. Failing in terms of usability seem to result in the rejection of these websites particularly by visually impaired(VI) users [2]–[4]. Recent studies showed that the only negative experience felt by VI users in SNS is frustration which caused by bulk of information in form of multi column layout [5]. The purpose of this study is to explore users' experience in SNS in multi column layout through the task analysis. This study specifically aims to focus on the navigation behavior in Facebook mobile version and desktop version and their emotional changes that conducted with twelve VI users. The findings enable to generate some suggestions to improve web page layout in SNS. The remainder of this paper includes the related work and methodology sections followed by results and conclusion.

2. RELATED WORK

The related works in this section are focused on navigation behavior, including complex layout and reading pattern; and examining relationships between emotions and navigation behavior.

2.1 Reading Pattern And Complex Layout

There are many studies related to general reading patterns for Web pages. Browsing is a rapid interactive process where most activity happens on the top-left quarter of the page [6]. VI users are using screen reader to browse web pages. Screen reader is the most popular assistive technology

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utilized by users with visual impairment. Screen reader is the software programs that convert text into synthesized speech and VI people are able to listen to web content. The most popular screen readers are JAWS and Window-Eyes [7].VI users interpret the web layout based on output from the screen reader that in audio form.

VI users "visualize" the layout by using navigation method such as from top to bottom, one line at a time, tab key, link, heading (if the web content has headings), from one frame to the next (if there are frames) [8–10].VI users have capability to "visualize" the web content through the interpretation by screen reader. However, VI users encountered problem when capability of screen reader limited in complex layout. This issues were discussed by Sri Hastuti [11] where screen reader will not have the capability to describe complex diagram/structure or a desktop layout to blind users. In windows environment, VI users are having problems in finding a file because they expected one dimensional array (hence only used the up and down arrow keys) while the directory was arranged as a two dimensional array.

Besides findings in windows environment, researchers have studied specifically how people read and use news Web sites [12], [13]. These studies revealed that when reading, people use different styles and activities. Reading, skimming, and scanning require different presentation, navigation, and visualization styles. Some of the best design approaches for sighted users, such as modular layouts, are some of the most problematic for VI users. The two dimensions of modular layouts pose a serious challenge. Converting two-dimensional presentations to a one-dimensional stream of speech is difficult. Researchers have been investigating this issue with presentations such as tables [14]. Complex document designs, such as modular layouts, can be very effective for sighted users but not for the VI users. There are many studies have proven useful findings in web page layouts [12],[13],[15],[16] but they do not ascertain directly how people interpret the layout in Facebook which consists mobile version and desktop version.

2.2 Emotions And Web Navigation Behavior

Emotions are simply a class of feelings, differentiated from sensation by their experienced quality[17]. Understanding users' emotions are very important during their web navigations activity. Users' psychological changes clearly will reflect their mental state whether they frustrated or enjoyed using any web sites.

There are number of studies focused on exploring the impact of emotions during web navigation. Arapakis examined the role of emotions in the information seeking process. The experiment involved completion of each task by manipulating the complexity and reporting users' emotional patterns. The study results revealed that users' emotions consistently changed from positive to negative valence, as the degree of task difficulty increases[18].Besides, Jones investigated unique characteristics of business-to-consumer (B2C) websites that could generate emotional reactions to the web experience. Since consumers of B2C engage in multiple actions, such as reading brand descriptions, downloading a video clip, or entering a chat room, this could evoke a variety of emotions. The researcher found that the emotions have effect on overall evaluations of the web experience as well as the brand [19].

Kim investigated how users' emotion control influences the Web search behavior. Kim found positive correlation between emotion and web search behavior [20]. The effects of users' emotions on information seeking was also studied by Kalbach [21].The authors outlines an Information Search Process(ISP) framework for understanding users' emotional states as they seek information on the Web. ISP framework which consists of search stage and goal, feelings, thoughts, actions and user need were used to track users' emotional changes and evaluate search engine results. The author found that users' positive feelings had increased interest to explore further during information seeking process. In the study of users' interaction with online shopping web sites, Mummalaneni discovered the effects of virtual store environments on shopper emotions and purchase behaviors [22]. Talya [23] proposed a model to study the impact of design qualities of a Web store on online consumers' emotions and attitudes toward the store. The study demonstrated the importance of design attributes and emotions in virtual environments. Many studies had explored web navigation behavior and information seeking among user. However there are lack of studies that showed the relationship between navigation behavior and emotional changes among VI users. Understanding VI users' web navigation behavior and their emotional changes can help to bridge the gap between end users and web designers.

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The study presented in this paper produced data that can be directly observed how people with visual impairment interact with complex layout and impact of their emotions during their navigation. The objective of the present study is to investigate relationship between layout and their navigation behavior on Facebook mobile and desktop version among blind users in Malaysia. Besides, this study is to enhance better understanding of how VI users' psychological changes affect their navigation behavior and their perception towards the web page layout. This study aims to answer research questions as follows:-

- What are the VI users' perceptions about Facebook mobile and desktop version?
- How web page layout influenced VI users' navigation activities?
- How web page layout influenced VI users' emotions?

This study is part of ongoing research of VI user navigation behavior in social network sites. Based on the results of this analysis, the authors will attempt to outline detail research on task analysis and physiological changes of social network for people interacting via screen reader.

3. STUDY

3.1 Methodology

Participants were given five tasks within the desktop version Facebook pages and mobile version Facebook pages. Specifically this study focus on communication-related features in Facebook as followed:

Task 1:Finding out friends
Task 2:Update status in new feed
Task 3:Write on wall of friend
Task 4:Write private message
Task 5:Logging out

Quantitative and qualitative data about the participants' perception of layout complexity were collected after completion of given tasks. The interview session was divided into three sections. In the first section, details about the participants such as demographic information, level of experience, type of visual impairment and usage of assistive technology were collected. In the second section, participants were given detail instruction of five tasks within the desktop version Facebook pages and mobile version Facebook pages. In the last section, users' reaction survey was carried out once the participants completed with the tasks given. This is to know their experiences and reactions, both in general and to specific features of the web page in Facebook desktop and mobile version. The observer was intentionally skipped out the task steps to determine how well the web page can guide users' interactions with it.

The participants been requested to make best guess about how to proceed using the information that have been given the webpage. Equipment such as computer, audio recorder and camcorder were used for the observation. The observation took one and ninety minutes and it conducted in naturalistic environment. There was no formal training given to the user before begin with observation on her navigation. Training is inapplicable because in reality people use the Web on a daily basis without any formal training [24].

3.2 Participants' Details

Twelve participants were participated in this study. They were six males and six females. All of them are VI users who are active internet users (refer to Table 1). The range of age of the participants is between 21 – 64 years old.

Table 1. *Participants' Type of Vision*

Type of vision	% of Respondents
Legally blind	16.67
Totally Blind	83.33

All participants depending on screen reader in order to view web content. All participants used JAWS for their web activities (refer to Table 2).

Table 2. *Type Of Screen Reader Used*

Type of screen reader	% of Respondents
JAWS	100.0%

Table 3. *Participants' Proficiency In Screen Reader And Computer*

Proficiency	% of Respondents		
	Advanced	**Intermediate**	**Beginner**
Screen reader	100.0	-	-
Computer	100.0	-	-

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4. RESULTS AND DISCUSSIONS

Quantitative data was analyzed including the initial data, the participants answered to the questions presented in survey form. The survey forms were given separately for Facebook desktop and mobile to the VI users once they complete their task. Qualitative data was analyzed in order to identify related issues and navigation pattern between participants' interpretations in Facebook mobile and desktop version.

4.1 VI Users' General Navigation Pattern in Facebook Mobile Version and Desktop Version

Information in Facebook is presented in form of multicolumn layout; arranged in stack of rectangle[12]. The biggest challenge for VI users is converting multidimensional presentations into single dimensional reading pattern by screen reader. VI users used various navigation methods in order to navigate around the web content. Navigating by using link, top to bottom and heading are the methods frequently used by them on web sites [25]. In Facebook desktop version, all of them used various type of navigation method for them to reach to the destination based on the tasks given. According to the VI users, various types of navigation method ease their navigation activities to 'visualize' the structure of web content and to estimate their destination. Searching become their favorite strategy to complete the task given to VI users. By searching, they move from main region to sub region to reach to their estimated destination area. Since the information in multicolumn layout, their navigation more complicated even for active users in Facebook. Based on general observation their navigation pattern is in "zigzag" pattern where moving from top-bottom-top in order to familiar with entire content in Facebook desktop version compare to Facebook mobile version (refer to figure 1). Since information in Facebook mobile version is presented in form of single column layout, only selected navigation method were used such as heading, tabs and searching for keywords. Based on general observation their navigation pattern is from top-to-bottom to familiar with entire content in Facebook mobile version (refer to figure 2).

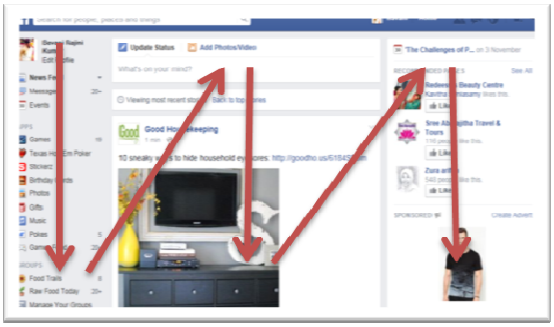

Fig. 1. Navigation Method In Facebook Desktop Version

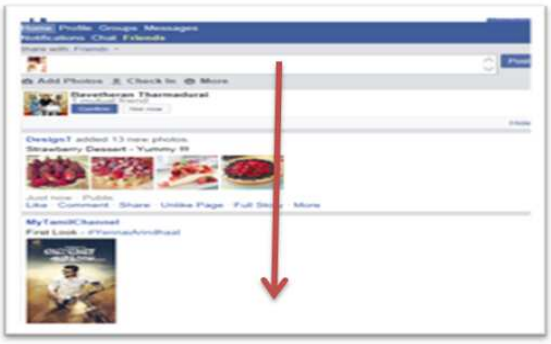

Fig. 2. Navigation Method In Facebook Desktop Version

4.2 VI Users' Perceptions in Facebook Mobile and Desktop Version

The analysis of the data collected revealed that there are differences in users' perception in Facebook Mobile and Desktop Version. According to participants' feedback on Facebook desktop version, they feel confused due to the layout inconsistency and it's always unpredictable. There are many types of web site available. However, each web site has their own modular layout design to convey their information to users. Since the layout always unpredictable, they need to spend more time to explore the web content by using their skills in screen reader. Majority of them feel that the content in Facebook desktop version not clear and understandable at all (refer to Table 4). They feel frustrated due to the complex layout and not well organized (refer to Table 4). VI users prefer to access to Facebook mobile version (even in computer environment) to avoid barriers desktop version. Majority of participants feel that the layout in mobile version is simple and well organized and they will strongly recommend to other VI users to access to the web site. Based on results in Table 5, it shows that majority of VI users prefer to access to Facebook mobile version since it has clear

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understandable, accessible web pages and easy to navigate without seek for other assistants. Based on the findings, it clearly shows that the layout become the major barrier for VI users to continue their journey in every web page. Whenever they are frustrated with the layout, there are delays happening in their navigation activities. It caused the lower rate for "strongly agree" section in Question 1 to Question 8 for Facebook desktop version compare to mobile version.

Table 4. Users' Perception In Facebook Desktop Version

Questions		% of respondents				
		1	2	3	4	5
1	This web site was easy for me.	33.3	16.7	16.7	25.0	8.3
2	Using this websites enable me to navigate more quickly	50.0	25.0	8.3	16.7	0.0
3	My interaction with Facebook was clear and understandable	33.3	8.3	33.3	25.0	0.0
4	The website very accessible with screen reader	50.0	25.0	16.7	0.0	8.3
5	Facebook desktop version having a simple layout and organized	75.0	16.7	0.0	8.3	0.0
6	I enjoyed using the website	50.0	8.3	25.0	16.7	0.0
7	I easily can find information without any assistant	33.3	16.7	16.7	25.0	8.3
8	I will recommend Facebook to my friends.	41.7	0.0	33.3	25.0	0.0

1=strongly disagree,2=Disagree, 3=Neutral, 4=Agree, 5=Strongly agree

Table 5. Users' Perception In Facebook Mobile Version

Questions		% of respondents				
		1	2	3	4	5
1	This web site was easy for me.	0.0	0.0	0.0	16.7	83.3
2	Using this websites enable me to navigate more quickly	0.0	0.0	0.0	16.7	83.3
3	My interaction with Facebook was clear and understandable	0.0	0.0	0.0	16.7	83.3
4	The website very accessible with screen reader	0.0	0.0	0.0	16.7	83.3
5	Facebook desktop version having a simple layout and organized	0.0	0.0	0.0	8.3	91.7
6	I enjoyed using the website	0.0	0.0	0.0	16.7	83.3
7	I easily can find information without any assistant	0.0	0.0	0.0	25.0	75.0
8	I will recommend Facebook to my friends.	0.0	0.0	0.0	8.3	91.7

1=strongly disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=strongly agree

4.3 VI Users' Emotional Changes in Facebook Mobile and Desktop Version

According to Ekman, there are existence of six or more basic emotions (happiness, sadness, anger, fear, disgust, and surprise), which are universally displayed and recognized (as cited in Lopatovska & Arapakis, 2011). One of the objectives of this study was to confirm the occurrence of emotions during VI users' navigation activity. In this study, question number six directly reflects the happiness where it comes from the positive feeling of every individual. Therefore, question number six was used as bench mark to analyze VI users' emotional changes towards the Facebook Mobile and Desktop Version. The analysis of the data collected revealed that

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there are strong relationship between VI users' navigation and emotional changes. When, VI users feel good and satisfied with layout, the percentage of VI users' who have positive response is increased.

For example, question number six is reflects VI users' emotional changes towards the Facebook mobile version and desktop version. In table 4, majority of VI users strongly disagree that they enjoyed using the websites however in table 5 majorities of VI users strongly agreed that they enjoyed using the websites. Whenever VI users have positive feelings, it impacts their perception towards Facebook mobile and desktop version. This is the main reason for higher percentage of disagreement especially for question number 1, 2, 3, 4, 5, 7 and 8 in desktop version (refer to table 4) compare to mobile version (refer to table 5) .

5. CONCLUSION AND FUTURE WORK

In this study, twelve participants were involved and several important conclusions can be drawn from the data collected. This study investigated VI user's perception and their emotional changes in Facebook desktop version and mobile version. Quantitative and qualitative data were collected to find VI users' perception and navigation behavior in Facebook desktop version and mobile version. At the same time, VI users' navigation pattern was observed during the completion of each task. Based on finding in this study, the researcher concludes that layout playing vital role for web navigation among VI users. The layout complexity is giving strong impact to VI users' web navigation activities and their emotions. It's clearly shows that the factors such as web page complexity, emotional changes and navigation behavior are strongly interrelated one and another. Decreasing the delay between the user's request and visual feedback could improve their perception towards Facebook desktop version compare to mobile version.

This survey is an initial step for finding users perception, emotional changes and common navigation pattern. However, additional analysis will be performed in order to validate the clarity of this argument. We believe that the quality and comprehensiveness of our data can provide much insight into the important of web layout for VI users. Detail research on reading pattern, task analysis and physiological changes during navigation activities will be the future research work. This study is part of ongoing research on navigation behavior in SNS among VI users.

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